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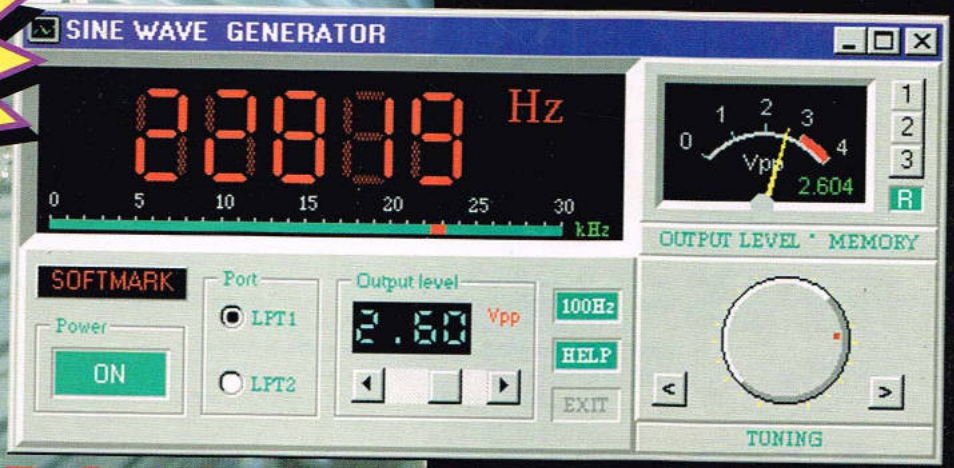

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AC A:	200uA, 2mA, 20mA, 200mA, 10A
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AC Current:	40mA, 400mA, 10A
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B 3275 INSIDE FRONT

Contents

SILICON CHIP
Vol.11, No.4; April 1998

FEATURES

4 Review: Philips DVD840 Digital Video Disc Player
Full-length movies from a CD-size disc – by Leo Simpson

12 Understanding Electric Lighting; Pt.6
The low-pressure sodium vapour lamp – by Julian Edgar

16 Review: VET Anti-Virus Software
Comprehensive anti-virus protection for your PC – by Ross Tester

74 A Chook Raffle Program For Your PC
Basic software program generates random numbers – by Rick Walters

88 Special Subscriptions Offer
Buy a subscription before June 1998 and get a bonus data wallchart

Philips DVD840 Digital Video Disc Player – Page 4

PROJECTS TO BUILD

34 An Automatic Garage Door Opener
Build it yourself and save money – by Rick Walters

56 Build A 40V 8A Adjustable Power Supply
Revised design has over-temperature cutout and is short-circuit proof – by John Clarke

66 PC-Controlled 0-30kHz Sinewave Generator
It plugs into your PC's parallel port; you drive it via a software-generated virtual instrument panel – by Mark Roberts

82 Build A Laser Light Show
Low-cost design uses a solid-state laser module – by Branco Justic

Automatic Garage Door Opener – Page 34

SPECIAL COLUMNS

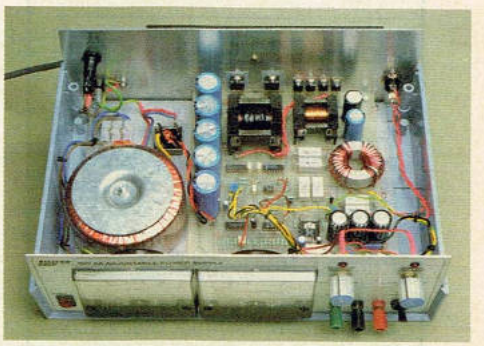
27 Satellite Watch
What's new on satellite TV – by Garry Cratt

28 Serviceman's Log
Lightning can cause strange faults – by the TV Serviceman

53 Computer Bits
DirectX 5: why you need it – by Jason Cole

70 Radio Control
Jet engines in model aircraft; Pt.4 – by Bob Young

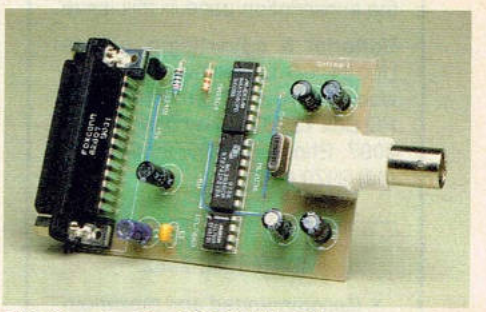
78 Vintage Radio
A farewell, an introduction & a Little General – by Rodney Champness



Build A 40V 8A Adjustable Power Supply – Page 56

DEPARTMENTS

2 Publisher's Letter
20 Mailbag
42 Circuit Notebook
44 Order Form
90 Ask Silicon Chip
94 Market Centre
96 Advertising Index



PC-Controlled 0-30kHz Sinewave Generator – Page 66

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Publisher & Editor-in-Chief
Leo Simpson, B.Bus., FAICD

Production Manager
Greg Swain, B.Sc.(Hons.)

Technical Staff
John Clarke, B.E.(Elec.)
Robert Flynn
Rick Walters

Reader Services
Ann Jenkinson

Advertising Manager
Brendon Sheridan
Phone (03) 9720 9198
Mobile 0416 009 217

Regular Contributors
Brendan Akhurst
Garry Cratt, VK2YBX
Julian Edgar, Dip.T.(Sec.), B.Ed
John Hill
Mike Sheriff, B.Sc, VK2YFK
Ross Tester
Philip Watson, MIREE, VK2ZPW
Bob Young

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PUBLISHER'S LETTER

Auckland's blackout is a timely lesson

No doubt there have been many jokes about blackouts over the last month or so, at Auckland's and New Zealand's expense. But Australia and most other developed countries are in no position to laugh. It could easily happen to us. Supposedly, the reason for the failures of the four oil-filled high voltage cables supplying Auckland is that they were very old and had not been properly maintained by the NZ electricity supplier, Mercury Energy. It is true that, as with many recently privatised electricity suppliers around the world, Mercury had laid off a lot of its staff and therefore it was probable that much maintenance had fallen by the wayside.

Many government and privatised Australian electricity suppliers are going down exactly the same path of retrenchments in the name of efficiency and profits. Well, as most people would suspect, maintenance schedules and reliability of power supply must suffer.

If you need any help in imagining just how bad this blackout in Auckland is, just consider how you would cope with little or no electricity for a period of several months! That is what has happened in the central business district of Auckland. The cost to big and small companies must be enormous.

Already, Mercury Energy has announced that it will probably have to sell its $NZ300 million stake in its neighbouring utility, Power New Zealand, to pay for the inevitable claims against it in the aftermath of the Auckland power crisis. You can expect that Australian energy authorities are taking a really close look at this disaster and the way it eventually pans out. Some people have suggested that Australian engineering staff presently in Auckland are not only there to assist but to also work out the best way to cope with a similar emergency if it happens here.

And don't think it couldn't happen here. As I understand it, the Sydney CBD is supplied by a similar setup. Are the cables well maintained? You'd better hope so because the costs of a similar power interruption to Sydney's CBD could run into billions.

One thing's for sure. This event will make energy authorities reassess the real cost of power generation and supply. If electricity customers are likely to sue a supplier to recover the costs of power interruption (and why shouldn't they?), then those costs are going to be built into power charges.

Insurance companies are also likely to very closely assess electricity suppliers' plant condition and maintenance before setting their premiums. And financial assessors such as Moody's Investment Services and S&P are going to be equally vigilant – they could easily downgrade the credit status of many state-owned and privatised energy suppliers in this country.

It's interesting, isn't it? Auckland's misfortune could place the drive for "efficiency" and privatision of Australia's utilities in a whole new light. That would be no bad thing.

I feel really sorry for the people of Auckland. In our own operation here at SILICON CHIP we have suffered the occasional blackout which has lasted several hours. The sense of frustration is overwhelming. Because we are so wedded to electricity in everything we do, literally everything comes to a halt during a blackout. You can't use the computers, you can't use the phones after an hour or so, you can't write with a pen (it's too dark), you can't work at the bench. You can't even make a cup of tea or even go to the toilet (it's pitch black down there!).

No, to have blackouts or no power at all over a period of several months would be unthinkable. At the very least we would have to move office or bring in a diesel generator to run the SILICON CHIP offices. Multiply that scenario over thousands of Australian businesses and you've got a real disaster on your hands.

You don't think it could happen here? I really do hope you're right!

Leo Simpson

MicroGram Computers

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An Ethernet TCP/IP terminal suitable for UNIX network environments, it supports multi sessions and multi hosts. It is also compatible with WY-60, WY120, WY-50+, PC Term, ANSI and DEC VT220 etc. A standard VGA colour monitor & standard 101 key AT keyboard connect to the terminal. One 10Base2 BNC, one 10BaseT RJ45, two serial ports & a standard parallel port are also fitted.

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Cat. No. 8521 **Bar Code Laser Omni-Direct. Scanner** $2119

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Cat. No. 2320 **ISA Quad-Channel EIDE Card** $199

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Cat. No. 17044 **WatchDog Timer Card** $139

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The Philips DVD840 digital video disc player has a host of technical features but it does not look much different from a typical VCR.

Review: Philips Digital Video Disc (DVD) Player

While there has been a great deal of talk about digital video discs (DVDs) in the media over the last few years, it is only now that players and program discs are becoming available. We recently had a look at the Philips DVD player and concluded that it was incredible technology. But it may not set the world on fire as a consumer product.

By LEO SIMPSON

That's the problem with technology these days. While it surges forward relentlessly, consumers don't necessarily grab onto something because it is the latest and greatest. There are a number of products where this has occurred or where they are yet to boom as consumer items: mini-disc, DCC, DAT, CD-I players and digital still cameras are a few examples.

We'll come to why we think that DVD players as a class might also fall into this category but first let's look at the Philips DVD-840. As we understand it, this Philips model incorporates most, if not all the standard features of present DVD players. It will play the new digital video discs, standard audio compact discs (CD) and video CD discs.

DVDs employ a new dual-layer technology and this allows double the digital storage of normal CDs. As well, the rate at which the data can be accessed off the disc is much faster than typical CD-ROM drives and this means that the system can give full motion video to the latest MPEG2 compression standard. By contrast, normal single layer video CDs use MPEG1 and so the picture definition is noticeably poorer.

The first surprise with the Philips DVD player is that it is so light. It is about the same size as a typical VCR, measuring 430mm wide, 81mm high and 308mm deep but it only weighs

4kg. Even without turning the machine on, that tells you two things. First, the designers have not needed to resort to massive rigid mechanisms in order to obtain the high data retrieval required. Second, they have been able to use very high levels of large-scale integration. In ordinary language, that means that they have crammed all the functions into just a few circuit boards and that means that a big power supply is not called for.

In fact, a glance inside the case shows that while there is not a lot of componentry inside, there is a huge amount of circuitry, although that might seem like a contradiction in terms. There is the player mechanism itself which looks like any CD or CD-ROM transport mechanism, a power supply board and a board to terminate all the RCA output connectors. As well, there is the main board which is in a shielded case and the boards for the front panel display, infrared remote and interface functions. These latter two boards are absolutely teeming with surface mount components so while there do not seem to be many LSI packages, there is clearly a great deal of circuitry involved.

When you see all those tiny surface mount ICs and other parts tightly packed on the PC boards, you have to admit that this is amazing technology. The developers of the CD (Philips & Sony) have learnt well in the decade or so since CDs were first introduced. Much of that learning has come about because of the wide-scale adoption of CD-ROM drives into computers.

Before we leave the interior of the machine, not only is the power supply quite small but it is evidently a switchmode type as well, even though the rated power consumption is only 17W. So instead of the modestly sized conventional power transformer that you might expect to see inside a VCR or typical piece of audio equipment, this has a bridge rectifier running off the 240VAC mains supply and feeding a 100µF 450VW reservoir capacitor. After that there is a tiny little switchmode transformer – no wonder this unit is so light. By the way, when the unit is in standby mode, its power consumption is a mere 4W.

Front panel

Apart from its size and mass, there is little in the appearance of the Philips DVD player that screams out that this

The remote control features a Jog/ Shuttle control for frame-by-frame slow motion.

is brand-new technology; quite the opposite in fact. If you look closely, you will recognise the CD drawer and buttons for Play, Pause and Stop. There is a headphone socket and its level control on the lefthand side of the machine and in the same position on the righthand side are a pair of 6.5mm microphone sockets and two mic level controls. This is a clue that this can be used as a Karaoke machine if you have the right program tapes (oops, discs). Apart from that, there is a bunch of other small buttons immediately above the microphone sockets but most of their functions are not immediately apparent.

Connecting the player

The first point which emphasises that this is not a replacement for a typical VCR is that you cannot connect it to any ordinary TV set. Since it does not have an inbuilt RF modulator, the Philips DVD player can only be connected to a monitor with direct video and audio inputs. In my case, I was able to get around the problem. I have an older TV set but it does have a SCART socket for direct video and audio connections. With a suitable SCART cable I was in business.

No doubt the Philips people would point out that if you want the full picture quality of which the player is capable, you need direct video connections instead of going via the antenna input on your TV set. They'd be right, of course, but there must be millions of consumers out there for whom this will be a major obstacle.

For video output signals, the rear panel of the DVD840 features an RCA type video socket together with an S-video socket. On the audio side, there are RCA sockets for two pairs of analog stereo outputs and an AC-3 digital output. The digital output can be connected to an AC-3 decoder to obtain full surround sound for a home theatre setup.

Regional code

Also on the rear panel is a label stating "Regional Code 3" and this refers to the fact that DVD players have been crippled by being restricted to various World regions. The regions are as follows:

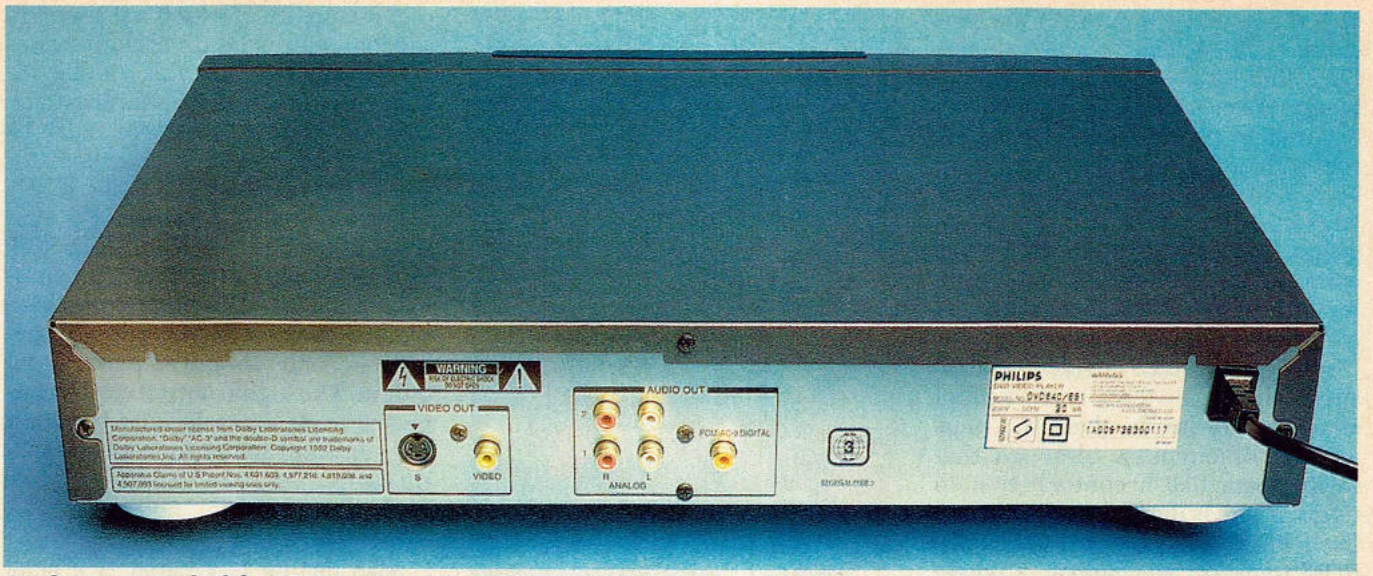
(1). Canada, USA & USA territories
(2). Japan, Europe, South Africa, Middle East
(3). Southeast Asia, East Asia (including Hong Kong)
(4). Australia, New Zealand, Pacific Islands, Central America, South America, Caribbean
(5). Former Soviet Union, Indian subcontinent (includes Pakistan, etc).
(6). China

Hence, if you buy a machine intended for Region 4, it won't play discs intended for other regions. This could really upset travellers who buy discs overseas and then come home to find that they won't play in their machine.

Actually, we wonder how long the DVD player manufacturers will bother enforcing this, since it was essentially forced upon them by the Hollywood film studios. Our review machine was stamped Region 3 and yet happily played Australian-produced movie discs. Clearly this regional locking can be disabled, at least by the manufacturers and their distributors.

We imagine it is done by some quite simple procedure such as changing a link setting inside the machine or maybe even simpler, by feeding it a code from the remote control. Maybe the process is more complicated than this but it is likely to be a small software change of some sort.

It stands to reason that this would be the case because the manufacturers



On the rear panel of the DVD840 there are a number of RCA sockets for video and audio outputs plus an AC-3 output for Dolby Surround sound decoders which can decode a digital signal. Note that there is no modulated RF output for connection to a TV set.

are hardly likely to produce a different machine for each region – they will be the same for the whole world. In fact the review machine was multi-standard, being able to play PAL or NTSC, so why would there be separate machines for different world regions.

Playing a disc

Place a disc in the drawer, push the open/close button and there is a bit of a delay while the machine works out what you've put in it. It displays "LOADING" at this time. If you have loaded a DVD it will come up with an opening menu on the monitor screen and you can decide to play the disc as you would a normal video tape. Alternatively, you can use the remote control to step through the menu to a particular scene.

There are two ways that the DVD840 will play an audio CD. First, you can hook it up to your normal stereo system and it will play the disc exactly as you would expect and respond to the remote control. For example, if you press "2" on the remote it will play track 2. It shows the track and time information on its front panel display, as would any normal CD player.

If you have it hooked up to your TV or monitor it plays in exactly the same way but the screen display is the most unimaginative I've seen. All you get is a blue screen with the word "track" and a little box next to it with the track number. If you press PLAY, it then says play while the track number continues to flash. Pretty exciting, huh? Why couldn't the designers have borrowed a leaf from a Windows CD player and had the same sort of features? Beats me. Even pretty ordinary VCRs these days have better on-screen displays.

All the same, as a CD player it is clearly up with the best of conventional CD players in terms of its specifications and its sound quality is just fine.

When you are playing a DVD, the on-screen display and all the options available depend on the disc itself and not the player. Therefore, you could have the option of showing the same video sequence from different camera angles, if in fact, the disc had been recorded with this information. None of the discs available with the review player had this feature and we assume that it will mainly be applied to sports footage.

One interesting feature is Zoom which lets you blow the picture up by a factor of four and you can move around the picture to select the area to be magnified. This can be useful in some situations but as you can imagine, the picture quality is not as good when Zoom is in use.

Having mentioned picture quality I should go on to state how good it is. First off, it is not as good as you might be led to believe from some overseas reviews. Ultimately, it is no better than the best pictures that a good PAL set is capable of. So the picture is equal to the best off-air reception that you would get in a strong signal area (no ghosts) and with a live studio shot, for example, a news reader or the weather forecast.

Where it is clearly superior to even the best VCRs is that the picture is essentially noise free at all times, and even when the picture is a low-light scene there is no noise. This latter case always shows up VCRs and their noise content is all too obvious.

Where the performance is also far superior to all but the best VCRs is in the clean noise free still pictures – they are very good. And this brings us to the remote control for the DVD840.

Remote control

As with most electronic appliances these days, most if not all functions are controlled via the remote control and many features cannot be accessed in any other way. This means that remote controls tend to have lots of buttons and a typical TV set's remote might have 50 or more. With some of their TV sets, Philips actually supply two remote handpieces, one with all the features and lots of buttons while the other one is simple, with just a few buttons for the main features.

This is a great idea! It means that if you lose one control temporarily, you can always fall back on the other one to get you out of trouble. Better still, you can put the main control away so that the junior people in the household don't have the temptation to fiddle with settings.

It's a pity Philips didn't take the two-remote approach with this DVD player because frankly, the remote control is not all that easy to use. It doesn't have all that many buttons but the layout does not seem logical or easy to use. Half the problem seems to be that the jog/shuttle control dominates the whole handpiece. The weight distribution also seems to be biased the wrong way so that the end you point is the heaviest. This is because the three AA cells are at that end.

One of the photos accompanying this review shows the layout of buttons on the remote control so you can see what I am talking about when I say that it is not easy to use. These days you expect a remote control to be essentially intuitive; you don't expect to have to consult the manual in order to operate even the most simple features. For example, where is the Play button. Peer at it for a while and you find it more or less centrally placed above the Eject button. Note that the Eject button is labelled but the Play button is not. Now where are the fast forward and reverse buttons? Answer: there aren't any. You have to first push the Jog/Pause button and then you must use the jog/shuttle control.

With the Jog/Pause button active, you can rotate the Jog dial back and forth to move the picture back and forth a frame at a time. All of which is very neat but I think it is a bit pointless. It might be attractive to people watching sports or porn movies but even there I think the attraction would quickly wear off.

Anyway, back to fast forward or reverse: to get the player to fast forward you have to have the Jog/Pause button active and alight, as already mentioned, and then you can get the unit to play at half, one eighth, normal, twice, eight times or 32 times normal speed, by rotating the shuttle ring. But this is not easy to do because if you rotate the ring by just a fraction too much, it flicks to the next mode. The shuttle ring needs some detents to help in this respect.

Fast forward at twice normal speed is the closest approximation to normal VCR operation in terms of normal motion of the subjects. Note that most VCRs have fast forward at about nine times normal speed although the picture quality in this mode is not a patch on a DVD player.

continued on page 96

SILICON CHIP

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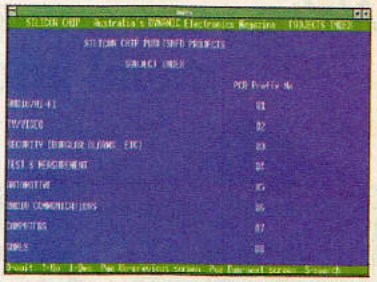

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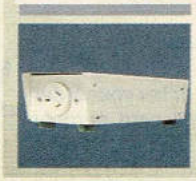

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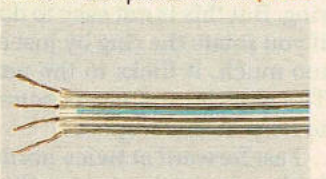

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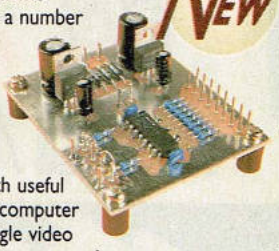

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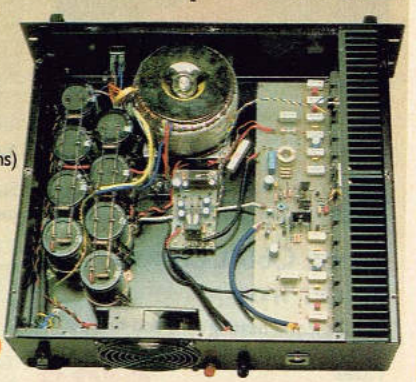

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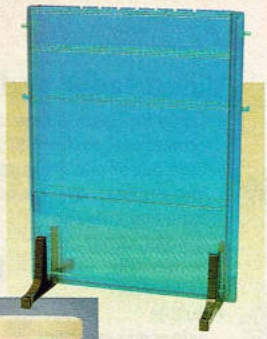

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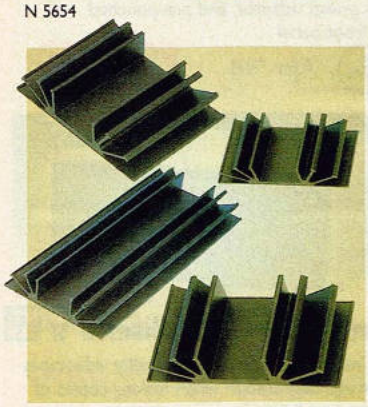

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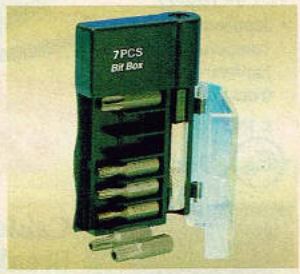

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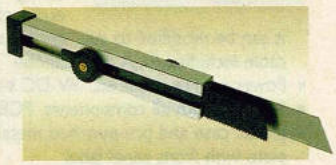

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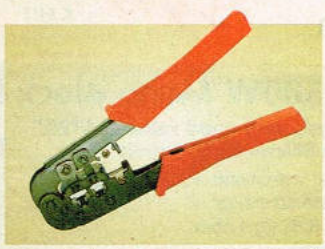

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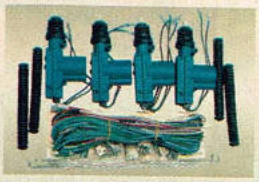

L 5421

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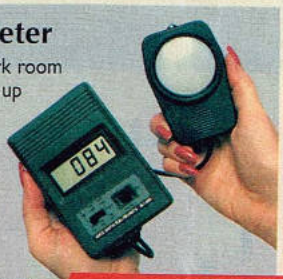

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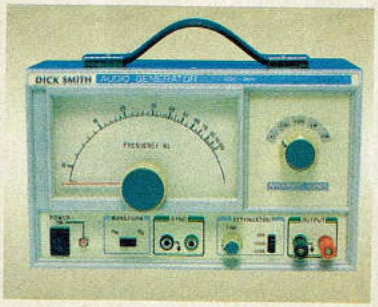

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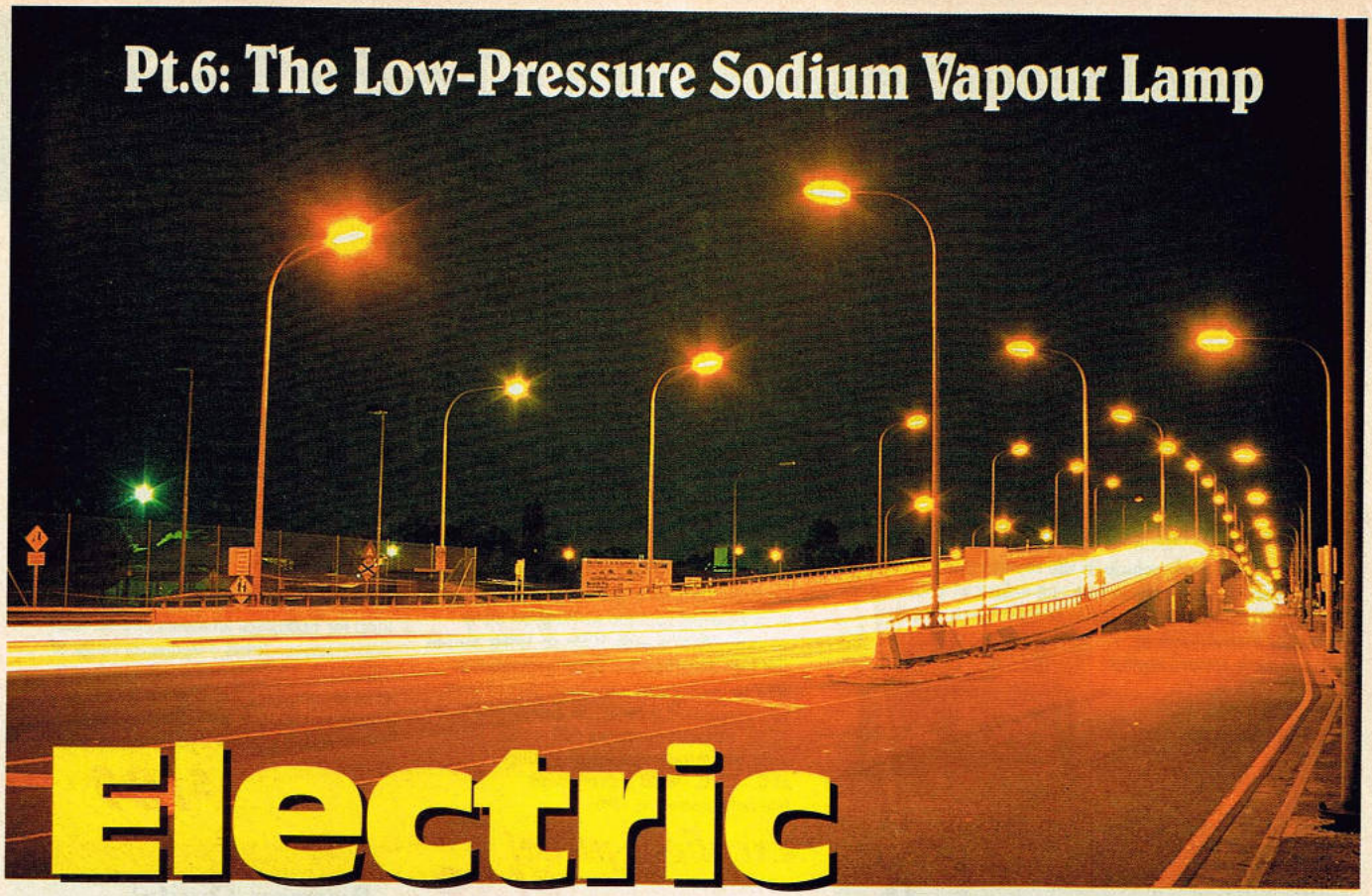
Pt.6: The Low-Pressure Sodium Vapour Lamp



Electric Lighting

The low-pressure sodium vapour lamp can be instantly recognised by its monochromatic yellow light. Widely used in road and security lighting, it is the most efficient light source manufactured.

By JULIAN EDGAR

The invention of a whole family of low-pressure and high-pressure mercury discharge tubes as possible light sources occurred in the period between 1890-1910. However, it took until 1920 for a discharge in low-pressure sodium vapour to be obtained, the main stumbling block being the required development of sodium-resistant glass. Even then, it wasn't until the 1930s that such lamps began to have a commercial impact.

In 1932, Giles Holst developed a low-voltage, low-pressure sodium vapour lamp. Working in Holland, he perfected a special glass that could withstand the highly alkaline affects of vaporised sodium. The lamp became widely used for street lighting in Europe and was introduced to the US in 1933 and in Australia in the late 1930s.

Construction

A low-pressure sodium lamp is similar to a fluorescent lamp in many ways. However, unlike a fluorescent lamp, a low-pressure sodium vapour lamp does not use the excitation of a fluorescent powder to produce the light. Instead, the sodium discharge itself produces the light.

The lamp consists of an evacuated glass envelope which contains a U-shaped discharge tube. The outer glass tube is coated on its inner surface with indium oxide. This coating reflects most of the heat (infrared) radiation back to the discharge tube while still allowing the transmission of visible radiation. This helps keep the

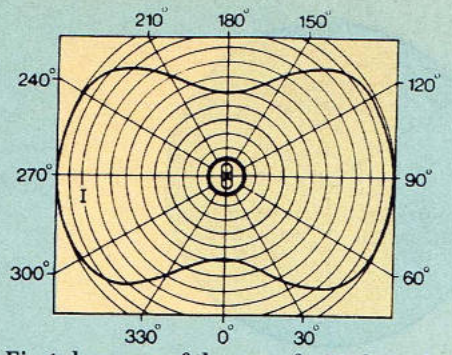


Fig.1: because of the use of a U-shaped discharge tube, the luminous intensity distribution of a low pressure sodium vapour lamp is not uniform perpendicular to its axis (Philips Lighting Manual).

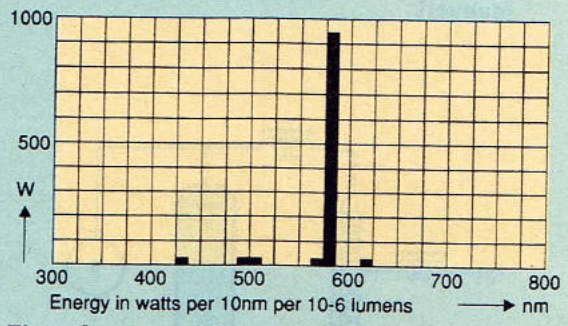
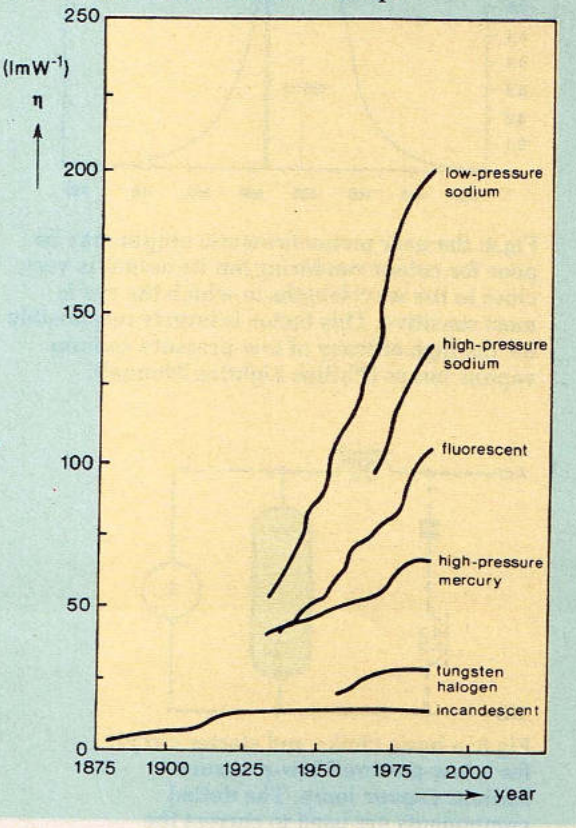


Fig.3: the spectral distribution of a low-pressure sodium vapour lamp is dominated by two very close wavelengths - 589nm and 589.6nm. This gives the lamp no colour rendering properties (Philips Light Sources).

Fig.2 (below): the luminous efficacy of the low-pressure sodium vapour lamp is better than any other common form of electric lighting - and has been for a very long time! (de Groot, J & van Vliet, J; The High Pressure Sodium Lamp).



discharge tube at its required 260°C operating temperature.

The discharge tube is made of soda-lime glass and is coated on its inner surface with borate glass. This ply-glass construction protects the soda-lime glass from the corrosive effects of the sodium vapour. The inner surface of the tube contains a number of small dimples, where the sodium condenses as the lamp cools after being switched off. If the dimples were not present, the sodium would condense during operation to form mirrors which would intercept the light and reduce the lamp's output.

The discharge tube contains metallic sodium of high purity. It is also filled with a mixture of neon and argon, which acts as a starting and buffer gas. In a similar way to fluorescent lamps, low-pressure sodium lamps have coiled tungsten wire electrodes positioned at each end of the discharge tube. These are coated with a mixture of oxides of barium, strontium and calcium.

Most single-ended sodium lamps use a bayonet mount so that accurate positioning of the lamp automatically occurs when the lamp is placed in the luminaire. This is required because the light output of a single-ended sodium lamp varies around its perpendicular axis. Fig.1 shows this variation in the luminous intensity distribution perpendicular to the longitudinal axis of the lamp.

Lamp performance

The greatest advantage of the low-pressure sodium vapour lamp over other types is its luminous efficacy. Fig.2 shows the luminous efficacies of a number of different lamp types over the last century or so. It can be seen that the sodium lamp has an efficacy much higher than that of other commonly-used lamps.

One of the reasons for this is the fact that low-pressure sodium lamps radiate almost entirely at two very close wavelengths - 589.0nm and 589.6nm. This can be clearly seen from the spectral distribution curve of a Philips SOX lamp (Fig.3). Although this monochromatic output provides little or no colour rendering, the wavelengths of light produced are close to the peak sensitivity of the human eye - see Fig.4.

In fact, although only about 35-40% of the input power is radiated at these wavelengths (compared with 65% at 253.7nm for a fluorescent lamp), the luminous efficacy of a sodium lamp is about twice that of a fluorescent lamp (see Fig.2).

In addition to its high efficacy and long life, another advantage of the low-pressure sodium vapour lamp is that its monochromatic light gives better visual acuity than multi-spectral light. This means that the eye can better differentiate objects that are close together. This occurs because there is no chromatic aberration within the eye when viewing an object under a monochromatic light.

The complete energy balance of a 180W low-pressure sodium lamp is shown in Fig.5. Of the 180W input,

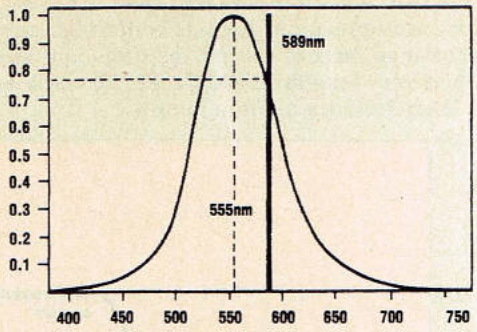


Fig.4: the near monochromatic output may be poor for colour rendering but its output is very close to the wavelengths to which the eye is most sensitive. This factor is largely responsible for the high efficacy of low-pressure sodium vapour lamps (Philips Lighting Manual).

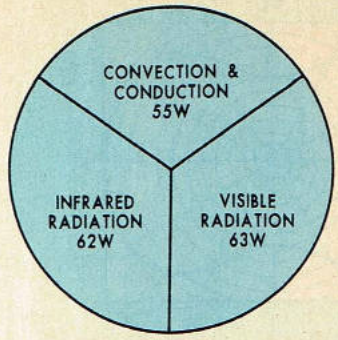


Fig.5: the energy balance of a typical 180W low pressure sodium vapour lamp: visible radiation - 63W; total IR radiation - 62W; convection and conduction - 55W (Philips Lighting Manual).

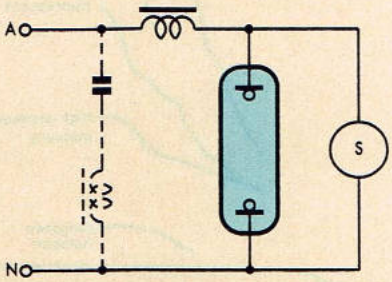


Fig.6: a basic choke and starter circuit for a low-powered low-pressure sodium vapour lamp. The dotted components are used to correct the power factor and block high frequency switching signals (Philips Lighting Manual).

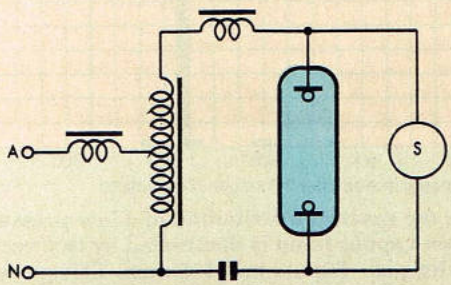


Fig.7: a constant wattage ballast circuit, as the name suggests, keeps the power consumption of the lamp approximately constant during the lamp's life (Philips Lighting Manual).

55W is lost by convection and conduction, 62W is converted to infrared radiation, 63 watts of visible radiation is produced

After switch-on, the lamp takes approximately 10 minutes to reach its stable operating condition. During start-up, it has a red appearance, the result of the neon gas discharge that initially occurs. This is short-lived because the sodium discharge soon takes over.

A life of up to 18,000 hours is quoted for common low-pressure sodium lamps - about 18 times that of a normal general-service incandescent lamp. A life of 18,000 hours is the equivalent of running continuously for about two years.

Unlike a fluorescent lamp, temperature fluctuations have little affect on lamp performance. This is primarily because of the good thermal insulation of the discharge tube provided by the outer glass envelope. The lamp is also able to be used in very cold conditions - down to as low as -30°C when fitted with an electronic starter.

Mains voltage fluctuations within the range of +6% to -8% also have very little affect on lamp performance. In fact, the change in lamp voltage is almost entirely balanced by a simultaneous change in lamp current, meaning that lamp wattage (and to a certain extent the luminous flux) remain nearly constant over a wide range of supply voltages.

Control circuits

As with other discharge lamps, a ballast is needed to prevent current runaway. Two main types of ballasts are used: (1) choke ballasts with or without a separate starter and (2) constant wattage transformer ballasts with a separate starter.

Sodium vapour lamps are quite short when compared with a fluorescent tube. Consequently, lamp voltages are relatively low and allow the lamp to be operated by a simple circuit such as the one shown in Fig.6. Here, a choke is wired in series with the lamp and an electronic starter is fitted in parallel with the lamp. The dotted components indicate a parallel capacitor for power factor correction and a filter coil which is fitted when high-frequency signalling via the mains is used. Ballasts of this type can be used with conventional sodium vapour lamps of up to 90 watts.

Constant wattage ballasts maintain lamp power at the same value during the life of the lamp. Fig.7 shows a

hybrid constant wattage circuit. It consists of a ballast, a series capacitor for power factor correction and an electronic starter.

Street lighting

A long lamp life, high efficacy and resulting low running costs makes sodium vapour lamps very suitable for road lighting. In addition, tests have shown that, as mentioned above, sodium lighting gives excellent visual acuity. In fact, if high-pressure mercury vapour lighting is used instead, the road surface luminance has to be approximately 1.5 times greater than for low- pressure sodium vapour lighting to give the same visual acuity. Furthermore, compared to other types of road lighting, sodium vapour lamps give a greater speed of perception, less discomfort, less glare and a shorter recovery time after glare has occurred.

While fluorescent, metal halide and high pressure sodium vapour lamps are also widely used for street lighting, low-pressure sodium vapour lamps reign supreme on main highways.

Road lighting luminaires are designed to direct light along the road length, with minimal lighting of houses lining the sides of the road. Their Downwards Light Output Ratio (DLOR) must be high - although one wouldn't always believe this to be the case when viewing a city at night from an aeroplane! However, a road lighting luminaire with a very high DLOR often has poor light distribution, necessitating the use of closer pole spacing. Fig.8 shows an isolux diagram for a typical road lighting luminaire.

The spacing of the poles, their height and their location are all vital parts of road lighting design. Fig.9 shows four different pole arrangements.

A single sided arrangement (Fig.9a) is used only when the width of the road is equal to (or less than) the mounting height of the luminaire. However, this arrangement inevitably results in a lower level of luminance of the side furthest from the poles. A staggered arrangement (Fig.9b) is used mainly when the width of the road is 1-1.5 times the mounting height of the luminaires. This, however, can result in a zig-zag pattern of light and dark along the road.

Placing the poles opposite one another down both sides of the road (Fig.9c) is used mainly when the width of the road is greater than 1.5 times the mounting height of the luminaires. Finally, there is the rare approach of using a span wire (Fig.10d), where the luminaires are suspended from a wire hung along the central axis of the road. This gives excellent luminance uniformity and less glare because drivers see only the blank ends of the luminaires.

Next month: the high pressure sodium vapour lamp. **SC**

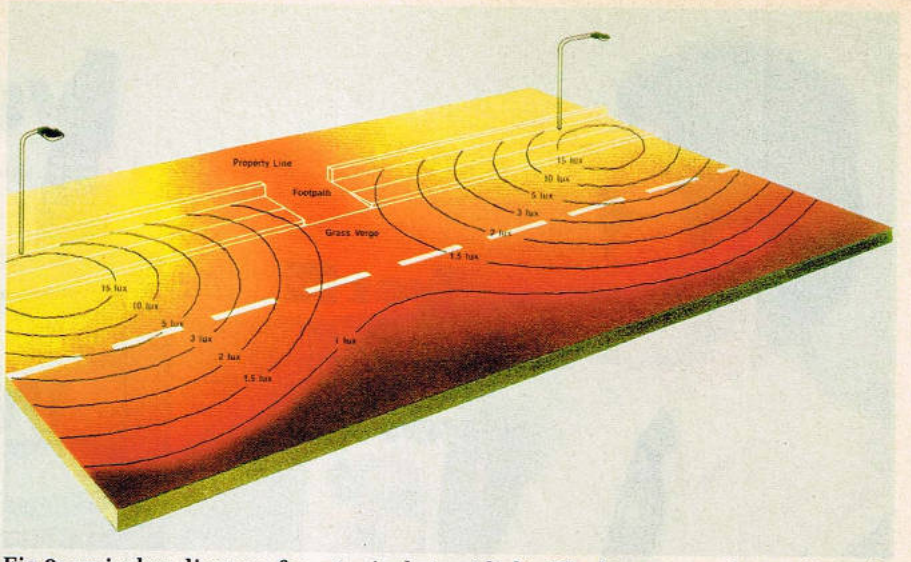


Fig.8: an isolux diagram for a typical street light. The lamps must be positioned such that the lighting is acceptably even along the road (Philips Commercial Lighting).

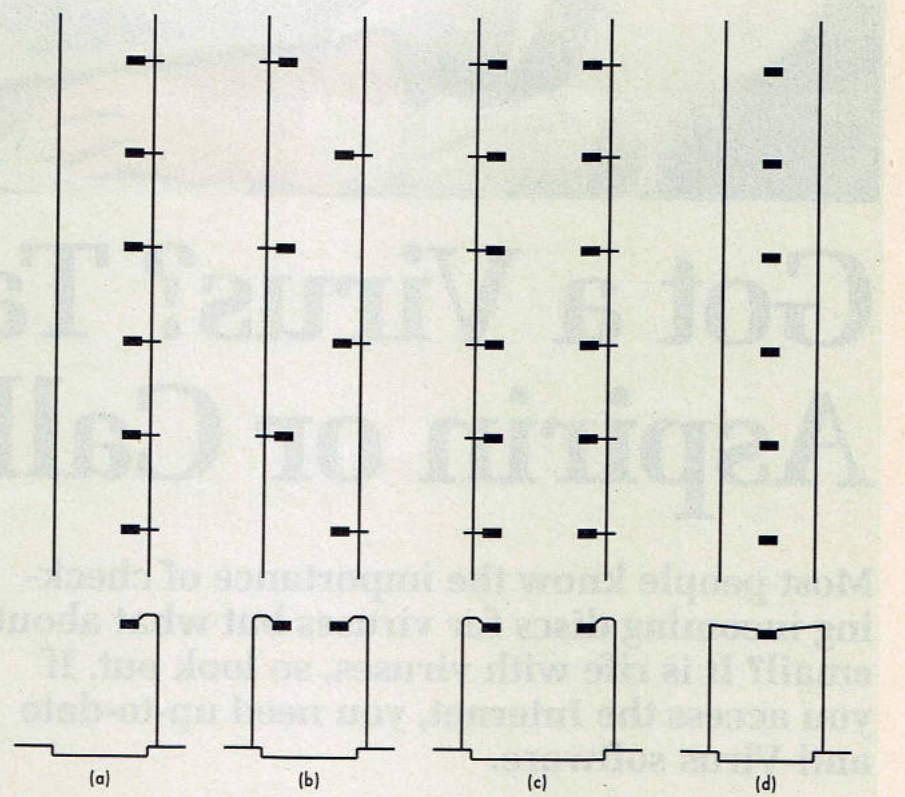


Fig.9: typical lighting arrangements for two-way roads: (a) single-sided, (b) staggered, (c) opposite, (d) span wire. Each approach has particular costs and benefits (Philips Lighting Manual).

Got a Virus? Take An Aspirin or Call A Vet!

Most people know the importance of checking incoming discs for viruses but what about email? It is rife with viruses, so look out. If you access the Internet, you need up-to-date anti-Virus software.

By ROSS TESTER

Every now and then, something happens to make you think you've actually beaten Murphy at his own game. This doesn't happen very often, mind you, but when it does, the feeling is sweet.

Such was the case one recent Monday morning, the start of the working week. One of the computer workstations on our network reported a Word macro virus – WM/Goldfish. In the overall scheme of things, Goldfish is not regarded as a particularly nasty virus but it's a virus just the same. It had not yet manifested itself on screen but if left, this particular virus periodically flashes a message that the goldfish is hungry. If you ignore the message after a while it starts feeding itself on the contents of your hard disc drive. That's not good.

Maybe the same "brain" that conceived this virus also thought of those infernal electronic pets which die if you don't feed them. But we digress.

Why were we caught? Perhaps an explanation of the SILICON CHIP computer network is in order. Most of the workstations run under Windows NT, mainly for its almost near-bullet-proof operation. As a matter of course, we run a virus check over these computers very regularly (which of course was how the virus was found and, more importantly, cleaned off). We also scan each and every floppy disc that goes into those machines.

A new computer, though, had been

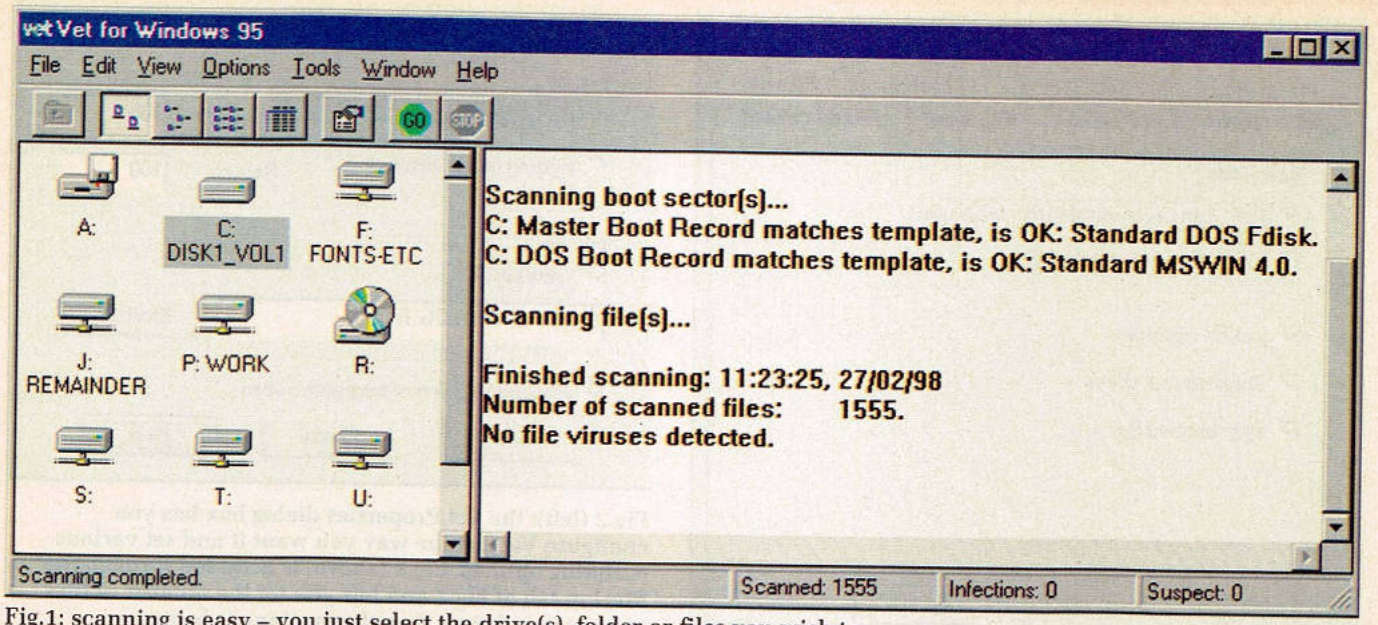


Fig.1: scanning is easy – you just select the drive(s), folder or files you wish to scan and click the Go button. A scan summary appears in the righthand pane.

supplied with Windows 95. And as luck (bad!) would have it, this machine was used to read a virus-infected floppy disc from a contributor. (When we rang to warn him, we were told "Oh yeah. I saw that message about the Goldfish being hungry but didn't know what it meant . . .")

To make matters worse, we didn't have any current virus checking software to suit Windows 95. So this machine was sitting there with a known virus on it waiting to re-infect the network. What to do?

The first step was to remove that machine from the network before turning it on. The second step was to quickly go out and buy anti-virus software to suit Windows 95. As luck would have it, our local "lolly shop" was itself out of stock, so we came back empty-handed.

And then it happened: the morning mail arrived and in it was a copy of Cybec 's "Vet Net Surfer" Anti-Virus Software for review. Talk about timing!

Normally, products for review take some time to be slotted in, to find someone with enough time to do the research, examine the product in detail, arrange photographs and write the article. Vet Anti Virus Software shot to the front of the queue faster than anything in history!

About viruses

Some viruses are pretty harmless while others are much more sinister and malevolent, capable of wreaking havoc to your computer or an entire network. But who is to know which is harmless and which is harmful? So all viruses need to be treated the same way – eliminated as quickly as possible.

Vet claims to detect and eradicate all of them. However, as we should all know by now, the maniacs who write and promulgate viruses are at it all the time, so any virus software worth its salt needs to be constantly upgradable. Vet does this by making the latest upgrades available on the internet or by mail but more of that later.

Most people who use a computer would know about viruses but they are changing all the time. For example, the type of virus which hit our system, a macro virus, didn't appear until mid 1995. Yet in just one year, they had become the largest cause of virus outbreaks worldwide!

What's a macro virus? It's a form of virus which hides within Word documents and Excel spreadsheets. Macros are little routines you can create to streamline tasks within programs and so they are typically incorporated into documents. They're a great idea but in 1995 some deviant realised they were also great for creating viruses.

When you open an infected file the macro virus is activated and can then automatically infect other Word or Excel files as they are opened. If you share files on disc or receive them via email, the macro virus is shared as well. While the latest versions of Word and Excel can warn you of macro viruses and give you the option of opening a file without any macros, they cannot destroy them. Apparently many shareware and freebie virus protection packages, especially older ones, cannot detect macro viruses either.

About Vet

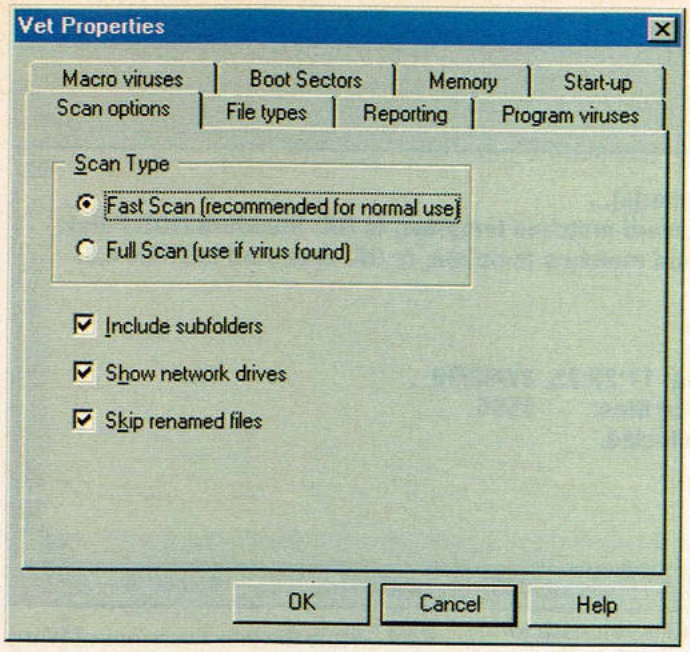
Vet Anti-Virus Software is Australian-designed and produced and sold around the world. That is a good reason to support it. It was first written back in 1989 by lecturer Roger Riordan to enable students to remove viruses by themselves, rather than tying up University staff. Continually updated, Vet now has around half a million users in more than thirty countries.

Vet has a variety of anti-virus software available to suit the needs of individual PC users, business users with standalone or networked PCs and also for network servers.

The program we were supplied, Vet Net Surfer, is just one of a number in the range. It's a full-featured virus protection package which can automatically detect and destroy viruses from virtually any source – infected discs, email attachments, and files downloaded from the Internet and bulletin boards; they're all prime sources of viruses.

Vet Net Surfer has a recommended retail price of $99.00 and is available from most computer stores.

As its name implies, the Vet Net Surfer package assumes you have access to the Internet. Therefore all up-



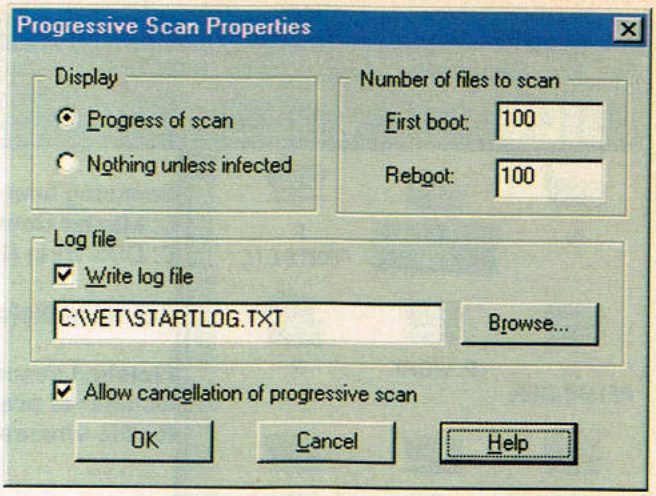


Fig.2 (left): the Vet Properties dialog box lets you configure Vet just the way you want it and set various scanning options. Fig.3 (above) is accessed through the Startup tab of Fig.2 and lets you set the number of files to be scanned each time the machine is booted.

grades to the packages are downloaded from the 'net. Once registered with Vet, you qualify for this service free of charge for a year. After that, an additional fee is payable – $40 per annum. Incidentally, also included in the box were versions of Vet to suit DOS and Windows 3.x, along with Windows NT.

Vet Premium is directed more towards small business. It contains the same anti-virus software as VET Net Surfer but in this slightly higher-priced offering ($129) the upgrades are mailed to you each quarter so you don't forget to keep your software right up to date (you can also get them from the 'net if you wish). Again, this service lasts a year and renewal costs $70 per annum.

As well as 'net access, registered users can also obtain unlimited phone and email support.

There are also Vet programs for larger organisations. Vet users include some very large businesses and government bodies, with many thousands of computers being protected.

Installation

Installation follows pretty much the standard routine these days – go to Start, Run, type in A:setup (our program was supplied on floppies but it's also available on CD-ROM) and let the setup Wizard guide you through the installation.

Again, as per most software, you can install a "typical" or a "custom" version. Not having used the software before, we went with the "typical" version. Installation from the two floppies took only a few minutes.

Various options are given during the installation process which allow you to choose such things as just how Vet will alert you to the fact that it has found a virus, how it will scan your discs and so on. Another switch tells Vet to scan all files, or only those files which are considered to be "runable", such as those with bin, com, dll, doc, dot, drv, exe, ovl, xls, xlt and sys extensions. You can add to this list if you wish.

In fact, we were most impressed by the amount of user control possible – see Fig.2. You can fully customise the installation to suit your needs, or you can simply allow Vet's default settings for a typical computer user. You are also given the opportunity to make a "reference disc", which can be used to reboot your computer complete with anti-virus settings should the worst happen and a nasty virus take over or destroy your hard disc drive's boot sector.

There's a Vet Anti-Virus package to suit all types of users and organisations and you can download virus update files from the Vet website.

Operation

The final part of the installation process is a complete scan of all local disc drives to ensure that they are clear of viruses. To us, this was the

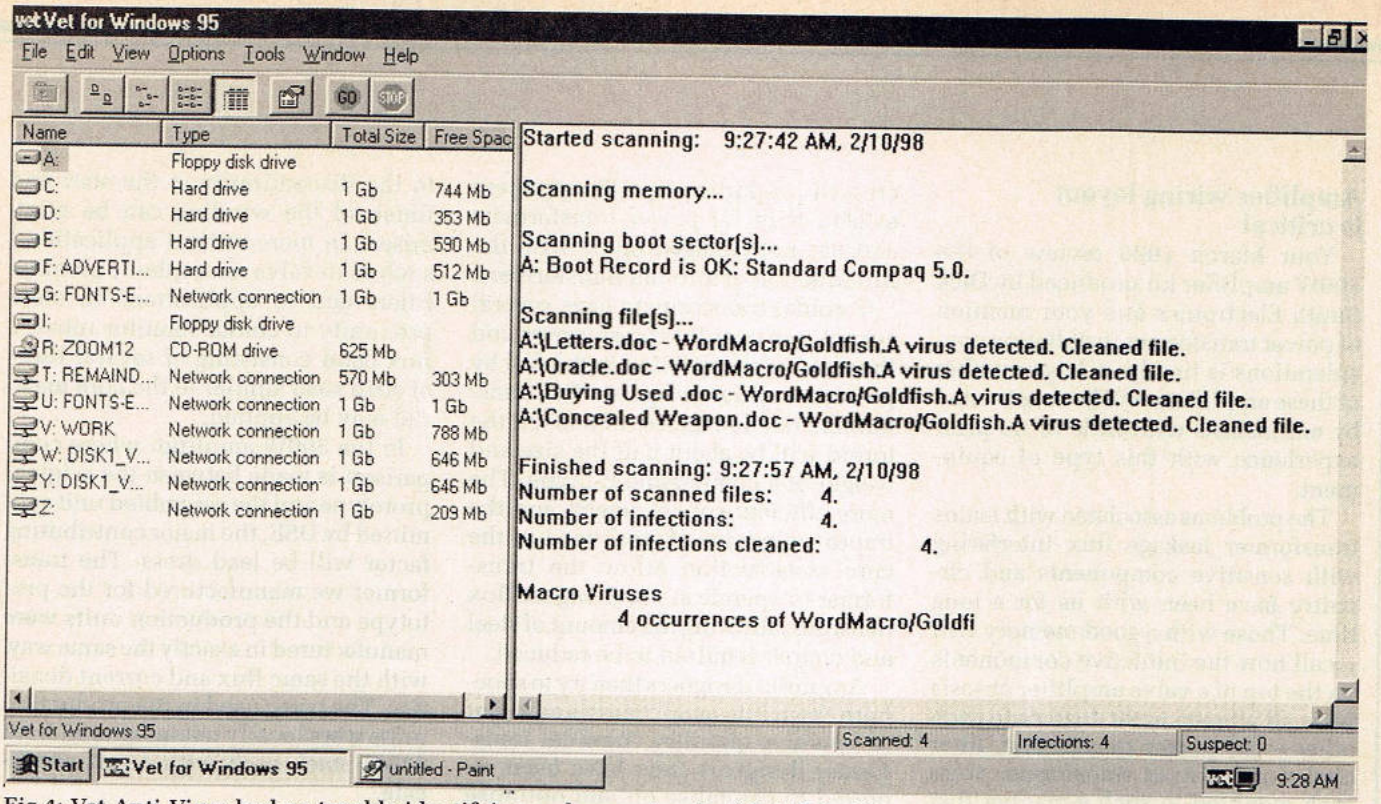

Vet Vet for Windows 95
File Edit View Options Tools Window Help
Name Type Total Size Free Spac
A: Floppy disk drive
C: Hard drive 1 Gb 744 Mb
D: Hard drive 1 Gb 353 Mb
E: Hard drive 1 Gb 590 Mb
F: ADVERTI... Hard drive 1 Gb 512 Mb
G: FONTS-E... Network connection 1 Gb 1 Gb
I: Floppy disk drive
R: ZOOM12 CD-ROM drive 625 Mb
T: REMAIND... Network connection 570 Mb 303 Mb
U: FONTS-E... Network connection 1 Gb 1 Gb
V: WORK Network connection 1 Gb 788 Mb
W: DISK1_V... Network connection 1 Gb 646 Mb
Y: DISK1_V... Network connection 1 Gb 646 Mb
Z: Network connection 1 Gb 209 Mb
Started scanning: 9:27:42 AM, 2/10/98
Scanning memory...
Scanning boot sector[s]...
A: Boot Record is OK: Standard Compaq 5.0.
Scanning file[s]...
A:\Letters.doc - WordMacro/Goldfish.A virus detected. Cleaned file.
A:\Oracle.doc - WordMacro/Goldfish.A virus detected. Cleaned file.
A:\Buying Used .doc - WordMacro/Goldfish.A virus detected. Cleaned file.
A:\Concealed Weapon.doc - WordMacro/Goldfish.A virus detected. Cleaned file.
Finished scanning: 9:27:57 AM, 2/10/98
Number of scanned files: 4.
Number of infections: 4.
Number of infections cleaned: 4.
Macro Viruses
4 occurrences of WordMacro/Goldfi
Vet for Windows 95
Scanned: 4
Infections: 4
Suspect: 0
Start
Vet for Windows 95
untitled - Paint
9:28 AM

Fig.4: Vet Anti-Virus had no trouble identifying and removing the "Goldfish.A" WordMacro virus from an infected floppy disc that had been sent to us.

acid test. We knew we had a virus; we even knew which hard disc drive it was on. Would Vet find it?

No problems at all. It found it and killed it. Or more correctly, it killed them – at least a dozen different infestations in various Word files opened the previous Friday and infected from the same source!

After re-booting the computer (part of the installation process), we went back to the floppy disc which we knew was the original source of the virus. The "screen grab" of Fig.4 shows that Vet successfully located and neutralised the virus in all four Word documents on that disc. Just to make sure, we re-ran Vet and it gave the floppy a clean bill of health.

Scanning techniques

Vet has two main ways to detect viruses: on demand scanning and resident scanning. As the name suggests, demand scanning occurs when you want it to – you must manually select the disc, folder or file to be scanned (for example, when you receive an e-mail attachment or insert an unknown floppy disc). Performing the actual scan is devilishly difficult: you just click the "Go" button and sit back while Vet does everything for you.

It takes only a few seconds to check a typical floppy disc and somewhat longer, of course, for a hard disc or CD-ROM.

Resident scanning, on the other hand, is automatic and almost transparent to the user. Every time you boot your computer, you can have Vet automatically scan a preset number of files (eg, 100) on each of your disc drives for viruses. This scanning function is progressive, so that eventually your entire hard disc is automatically scanned. If you subsequently reboot your computer during the day, you can have Vet perform a smaller or even no scan to save time.

You can also have Vet automatically eradicate any viruses it finds or warn you that viruses may be present. This is also pretty quick – about 20 seconds in our case – so you won't have to sit and watch the paint fade on the wall while waiting.

Conclusion

We had a lucky escape, although the person concerned should have known better. No harm was done in this case; we were able to get rid of the virus before it had a chance to do any damage. But this little episode shows just how easy it is to pick up a virus.

If you ever accept a floppy disc from anyone else, download a file from a bulletin board or the 'net or even receive email, you should have anti-virus software installed. Readers with children using their computers should be especially careful – games copying and swapping, albeit illegal, is rife in schools and is a renowned method of virus transfer. (Most schools and colleges have very firm rules about bringing floppies from home; some have even gone to the trouble of removing floppy drives. But it still happens).

And finally, you might think that CD-ROM discs are safe from viruses. They are safer but not safe. There have been some very embarrassed software distributors who have sent out CD-ROMs in the past complete with viruses. And these days, with CD-ROM writers becoming so inexpensive, non-commercial CD-ROMs have to be viewed with just as much suspicion as floppy discs.

We are particularly happy with the way Vet installs and operates and can give no better recommendation than to say that we will continue to use it here at SILICON CHIP.

Vet Anti-Virus Software is distributed by Cybec Pty Ltd, 1601 Malvern Road, Glen Iris, Vic 3146. Phone (03) 9825 5600; fax (03) 9886 0844. It is also available from Vet Anti-Virus Software, Auckland NZ. SC

MAILBAG

Amplifier wiring layout is critical

Your March 1998 review of the 500W amplifier kit produced by Dick Smith Electronics and your mention of power transformer installation considerations is timely. A large number of these amplifiers will be constructed by enthusiasts with little or no prior experience with this type of equipment.

The problems associated with mains transformer leakage flux interfering with sensitive components and circuitry have been with us for a long time. Those with a good memory will recall how the inductive components on the top of a valve amplifier chassis were all aligned at 90 degrees to each other – the power transformer, filter choke and output transformer were each mounted in such a manner that the leakage flux from one would have minimal affect on the other two.

Transformer designers well understood these problems and devised standard procedures both in the design and assembly phases of the transformer to reduce these effects. This involved judicious selection of flux density in the core and current density in the windings. Often the power transformer would also be fitted with a flux band to provide an effective shorted turn for leakage flux. In extreme cases the transformer might also be mounted in a steel case. Little could be done for the filter choke however.

With the advent of large solid state amplifiers, peak currents in power supply conductors have become much larger. Where the typical valve amplifier had been in the range 10-50W, with peak currents around 200mA, we are now faced with amplifiers of typically 50-200W, with peak currents well in excess of 10A. Our experience of these new problems goes back to the late 1960s with 70W amplifiers to a design from an RCA application note where lead dress from the filter capacitors to the output transistors was critical.

Many years and many amplifiers later the problem has only become worse as amplifiers have become more powerful and peak currents have increased proportionally. The problem existed with E-I power transformers and has not changed much with the introduction of toroidal transformers.

Toroidal transformers have several advantages over E-I transformers and these are now exploited to the full by power amplifier designers. For transformers rated in excess of 500VA, the toroid will be about half the size and weight of a comparable E-I type. The more efficient core geometry and the improved grades of steel used in the core construction allow the transformer to operate at much higher flux densities, allowing the amount of steel and copper required to be reduced.

Amplifier designers then try to shoehorn them into small chassis adjacent to sensitive circuitry. Toroidal transformer designers then have been required to capitalise on and optimise the self-shielding characteristics of the toroidal core.

Due to the circular nature of the core and the fact that the strip from which it is made is cut in the rolling direction of the original mill roll, the crystalline grain structure is prealigned in the direction of the induced flux in the core. This (and the fact that there isn't an air gap) is the reason the primary magnetising current in a toroidal transformer is so low compared with a comparably rated E-I transformer. Thus most of the induced flux remains within the core. In a wound toroidal transformer the factors which most influence the amount of leakage flux are the flux density, winding symmetry of the primary winding and the current density in the secondary winding.

The designer is able to optimise the flux density and current density but the primary winding symmetry is influenced by other factors such as the option of automatic alternate traverse (really the only toroidal transformer winding operation that can be semi-automated) and the skill of the operator. If continuous traverse is chosen, then winding costs will necessarily increase and insulation of the start of the winding is more critical.

However, if the operator is sufficiently skilled then flux leakage due to the discontinuity at the start and finish of the winding can be minimised. In more critical applications, such as in valve microphone preamplifiers and in applications in close proximity to colour monitor tubes, a flux band consisting of several turns of strip steel similar to the core material may be applied.

In the 500W amplifier where comparison is made between the original prototype and the assembled unit submitted by DSE, the major contributing factor will be lead dress. The transformer we manufactured for the prototype and the production units were manufactured in exactly the same way, with the same flux and current densities. The cores used in the production units were locally manufactured from 27M3 steel, each with a test certificate.

There will always be some flux leakage from a wound toroidal transformer and this will be found to be concentrated where the primary leads exit. By being aware of this it is (usually) a simple matter of keeping the mains wiring well away from sensitive circuitry. This would be done as a matter of course for safety reasons anyway. In spite of all this, some improvement may still be achieved by a small amount of rotation as you suggest.

However, in our experience, in this type of amplifier radiation from the power supply conductors is the main source of residual low frequency noise and distortion. Radiation from the output leads can also have a major effect on distortion (not to mention stability). It is important to use the largest cross sectional area conductors which can be accommodated, run them as close to a grounded earth plane as possible and in the case of a bipolar supply to maintain symmetry with respect to sensitive circuitry.

In the 500W amplifier it can be seen from the photo on page 64 of the March 1998 issue that you have laid out the PC board with this in mind but the leads from the capacitor bank to the PC board simply take the shortest route. Worse is the twisted pair output leads where they run directly over the input leads. A little care here and

the use of heavier conductors could achieve a lot. The size of the secondary leads on the power transformer is a good guide as to the size of cable required (also for the output leads).

You are to be commended for producing a project such as this as there is a very large market for amplifiers of this capacity. Over the next few years you will undoubtedly see many locally manufactured high power amplifiers come on the market in various forms and configurations which have had their genesis in this project.

Dick Smith Electronics are also to be commended for producing the amplifier as a complete kit and not being embarrassed by the necessarily higher price which that requires. They are to be commended also for choosing to use a locally manufactured transformer in their kit. They could have chosen to use an imported unit to save a few dollars but at what cost? The power transformer is by far the single most expensive item in the kit.

It is disappointing to see the market penetration achieved by imported transformers when there are so many local manufacturers producing world class products at world competitive prices. A healthy spirit of competition exists within the industry and this benefits the customer both in the price of the product and the willingness of the manufacturer to manufacture to a specific requirement on short notice.

Customers should not be afraid to ask the manufacturer of his choice for an oddball design. If it can't be done he will tell you and suggest an alternative. Use him as part of your design team (and the earlier the better). Look for the 'Australian Made' logo on transformers just as you do on packets at the supermarket (you do, don't you?).

Keep up the good work.

Peter Buchtmann,
Harbuch Electronics Pty Ltd,
Hornsby, NSW.

Notes on NiMH batteries

I have recently assembled a battery pack using NiMH (Nickel Metal Hydride) cells for replacement in a mobile cellular phone. The cells arrived individually packaged from the supplier and measured open circuit voltages between 0.6V and 1.1V. The pack was assembled and charged at the specified current for the specified hours and then the individual cells measured again on open circuit and they varied substantially. I proceeded to charge the lower voltage cells individually until they reached ±0.02V of the highest voltage cells and the pack has performed superbly since with maximum storage capacity.

It seems to me that it is essential to ensure that each cell in a pack has reached its full capacity before being first put into service, otherwise the lowest charged cell determines the total battery capacity subsequently. The assumption that all new cells arrive in a discharged state appears to be wrong.

On a related subject, I recently had to zap an NiMH battery and on recharging it, found it had acquired a full charge. It was then run down using a discharger till it reached the 1.1V level. It was fully recharged again and after sitting idle for one week, discharged again and its capacity had dropped to 10% of its rating. Obviously its self-discharge had altered drastically and it was no longer fit for service.

My experience is that good cells retain 90% of their remaining capacity after one week of idleness, so that after one month they still retain $(0.9)^4 = 65\%$ of their capacity. I find it useful to use cells intermittently and use up all their capacity before recharging. This ensures that I can obtain maximum life out of the cells since they can usefully withstand say 400 recharges before their capacity drops to 50%.

The practice of regularly discharging cells before recharging seems wasteful and it would be better to use them till they reach 1.1V. It is good to have a spare set of cells on hand if absolutely necessary or better still, use a fast recharger (say 1 hour) during which time planning for the balance of the job can be carried out.

V. Erdstein,
Highett, Vic.

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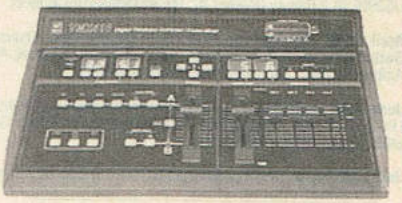

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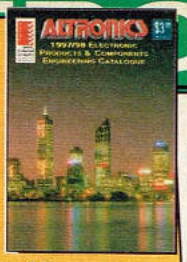

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Rectangular 230 x 125mm Horn Tweeter
200W Max Power, 105dB @ 2.83V/1m
C 6175 **$39** ea, or **$35** ea 4 & up

Phase Aligned 174 x 130mm Cluster Tweeter
MASSIVE 400W RMS POWER HANDLING!
400W RMS Power, 105dB @ 2.83V/1m
C 6180 **$89** ea, or **$80** ea 4 & up

Round 63mmØ Polycarbonate Dome Tweeter
150W Max Power, 108dB @ 2.83V/1m
C 6205 **$19.95** ea, or **$18** ea 4 & up

Round 74mmØ Polycarbonate Dome Tweeter
200W Max Power, 108dB @ 2.83V/1m
C 6215 **$29.95** ea, or **$27** ea 4 & up

PC FM Radio Receiver

FEATURED IN SILICON CHIP MAY '97 SHOWCASE!

Turn Your PC Into a FM Radio! Simple "Plug-In" Installation.

A plug-and-play FM broadcast band receiver for your multimedia PC! Plugs into the RS-232 serial port (DB25), and has an audio output which connects to your PC's sound card. The Windows-based tuner includes memories for your favourite stations, seek tuning and even a frequency display! Once tuned, the radio will operate in the background while you use the computer for other tasks. The software can be closed while the radio continues playing, saving RAM. Package includes radio module, stereo 3.5mm jack audio lead, antenna and software. No external power required, covers 87.5MHz to 108MHz FM band. 40mV rms output at 60dB S/N ratio. Requires 386SX or better CPU, sound card and Windows 3.1/'95 OS.

A 0900 Normally $49.95, NOW **$35**

Universal Cable Checker

Similar commercial units sell for more than $200! Build your own and SAVE HEAPS!

EXCLUSIVE TO ALTRONICS! Attention musos, roadies, installers, and enthusiasts! Here is a great piece of test gear, a Universal Cable Checker. Make sure that your cables are in good shape before a gig or installation. Checks continuity of: • 3-pin XLRs • Mono & stereo 6.35mm jacks • Stereo RCA leads. • Push-to-test operation. A tricolour LED display shows the status of each conductor of the lead, so if a short or open circuit exists, you know just where it is! Also has low battery and out-of-phase indicator for checking balanced leads. Supplied with silk screened and punched front panel, available in kit or fully built form. Requires 9V battery (not included).

K 2569 Kit Version **$69**
Q 2590 Built and Tested Version **$139**

UpTeK Professional Digital Multimeters

Altronics has been appointed Australian distributor for this fine range of UpTeK digital multimeters. These superb meters are ideal for the hobbyist and professional alike. All feature UL approved fuse protection on current inputs, large high contrast 3.5 digit LCD displays, high quality instrument leads, built-in stand and rugged construction. If you want the best performing multimeter for your dollar, then look no further than these excellent instruments.

All are supplied with high quality, silicon rubber insulated instrument test leads.

Note: Q 1115 rubber holsters pictured are available in yellow only, and are sold separately for $12.95 ea.

NEW!

Each UpTeK DMM is backed up by a *3 Year Warranty!*

43 Range LCR DMM
- 20MHz Frequency Counter
- Incorrect Lead Socket Beeper
- Peak Hold & Data Hold
- Auto Power Off
- Inductance < 2mH - 20H
- Capacitance < 20nF - 2000µF
- Frequency < 2kHz - 20MHz
- AC Volts < 200mV - 750V
- DC Volts < 200mV - 1000V
- Resistance < 200Ω - 20MΩ
- Continuity Buzzer
- AC/DC Current < 200µA - 10A
- TTL/CMOS Logic Tester
- Diode Check

Q 1108 **$149**

Auto Ranging DMM
- 32 Segment Bar Graph
- Manual Override of Auto-ranging
- Incorrect Lead Socket Beeper
- Range Hold & Data Hold
- Auto Power Off
- AC < 320mV - 750V
- DC Volts < 320mV -1000VDC
- Resistance < 320Ω - 30MΩ
- Continuity Buzzer
- AC/DC Current < 320µA - 10A
- TTL/CMOS Logic Tester
- Diode Check

Q 1104 **$129**

30 Range DMM
- Temperature -50°C to 1100°C
- Data Hold
- Auto Power Off
- AC Volts < 200mV - 750V
- DC Volts < 200mV - 1000V
- Resistance < 200Ω - 20MΩ
- Continuity Buzzer
- AC/DC Current < 200µA - 10A
- Diode Check

Q 1102 **$109**
Q 1103 Thermocouple **$15**

***TRUE RMS* 34 Range DMM**
- True RMS AC measurement to 5kHz
- Frequency Counter < 2kHz - 20MHz
- Data Hold
- Auto Power Off
- Low Ohms Capability (< 20Ω)
- Zero Adjust on Low Ohms
- AC < 200mV - 750V
- DC Volts < 200mV - 1000VDC
- Resistance < 20Ω - 20MΩ
- Continuity Buzzer
- AC/DC Current < 200µA - 10A

Q 1106 **$119**

BONUS THIS MONTH! Purchase any one of these excellent digital multimeters, and receive a shock-proof rubber carry holster, valued at $12.95, absolutely ***FREE!!***

12" PECC Woofer

A Bass Driver with SERIOUS GRUNT!

A serious bass driver for producing mind-bending bottom end! Ideal for use with our LeSon tweeters to make your own DJ bins or high power speakers. Features Poly Emulsion Coated Cone (PECC) for extra rigidity, nitrile rubber surround, long-throw suspension, eight-screw gasket and massive 1.4kg magnet. **Max Power:** 160W, **Impedance:** 8Ω, **Freq. Response:** 25Hz - 3kHz, **Qts:** 0.22, **Vas:** 289 litres.

C 3030 Normally $169, NOW **$129**

35A Diode Bridge

The KBPC3504 bridge is rated at 400V @ 35 Amps. Ideal for power supplies & amplifiers. Has a metal case for bolting to a heatsink and solder lug connections.

Z 0091 Normally $6.15 each,
NOW **$4** ea,
or **$3** ea 10 & up

Ideal for Power Supplies, Power Amps etc

Mini Siren

Makes an absolute din for such a tiny siren! Includes metal mounting bracket and fly lead connections. Blasts out 105dB at 1m, and operates off 6 - 16V DC @ 300mA. *Dimensions 40W x 44H x 57L.*

S 6120 Was $18.85,
NOW ONLY **$12**

Add an internal siren to your car alarm! Can even be hidden on motorcycles!

1-800 999 007 PERTH (08) 9328 1599

Doc GL778

OVERNIGHT DELIVERY

Weather Proof Sound Monitor Speaker Kit

What A Great Idea!

This kit includes everything you need to construct your own pair of weather proof monitors! They're fantastic for patios, pool sides, games rooms and extension speaker applications. Kit consists of ABS housings, end caps, baffles, 100mm *weather-proofed* drivers, screws and connection cables. All you'll need to build them is a screwdriver, soldering iron and a tube of silicon sealant or similar.

Don't pay hundreds of dollars for expensive imported monitors! Build your own and save!

CX0910 Only **$79** a pair

Enjoy your sound system outside! Build your own set of weather-proof monitors!

Includes the Famous Wacki Bracket for easy mounting!

Learning IR Remote Control

with LCD Backlit Touch-Screen

Are you sick of having remote controls all over the coffee table? Always picking up the wrong one? This *learning* remote control can replace up to eight remote controls! It features a multi-function ***touch sensitive backlit LCD*** screen that displays a range of function buttons to match the selected mode.

Featuring 8 different appliance modes, it can control TV, VCR, CD, LD, AMP, TAPE/TUNER. It also has two auxiliary modes SEL1 and SEL2, which can each be configured as a TV, VCR, CD, LD, AMP, or TAPE/TUNER device.

When you select a mode, the unit changes the buttons on the display to mirror the typical controls of the selected device. AMP mode even includes Surround Sound channel adjustment buttons. The unit is programmed from an original, working, remote. Also features backlighting (unlike others on the market) which is essential in darkened rooms. It's light sensitive, so the backlighting only activates in rooms with low light levels (saving batteries). Once activated, the backlighting stays on for about five seconds, and then dims off. Requires 4 x AAA batteries (supplied).

Get rid of your coffee table remote clutter with this amazing unit!

A 1000 Normally $239, *APRIL SUPER SPECIAL* **$199**

SAVAGE Discounts on Instrument Cases!

As a result of a huge scoop purchase, Altronics can now offer these cases to you at rock bottom prices!

As used in many EA and SC kit projects and by many major manufacturers Australia wide, these instrument cases are moulded from ABS plastic and feature internal mounting posts, PCB guide rails and vent slots. Attractive textured finish, with removable black front and rear panels. • Very easy to drill and machine • Requires no painting • Panels can be direct machine engraved or silk screened. **Available in light grey or black.**

At These Prices, Why Not Stock Up for Future Projects?

Small Case Dimensions - 200W x 155D x 65H mm

H 0480F Light Grey Case H 0481F Black Case

Normally $13.95 ea, **This Month $9**, or 4 & up **$7.50** ea

Large Case Dimensions - 250W x 190D x 80H mm

H 0482 Light Grey Case H 0483 Black Case

Normally $17.50 ea **This Month $12**, or 4 & up **$9.50** ea

Toroidal Transformers

We've got a ***strictly limited*** quantity of these high quality toroids to clear! They're as used in many of our own kit projects and products. Selected voltages available, but be very fast, these will go quickly!

TOROIDAL SELLOUT! SAVE OVER 35%!

M 4008 50VA 9V+9V Was $29.95, NOW **$19**

M 4025 50VA 18V+18V Was $34.95, NOW **$22**

M 4065 160VA 30V+30V Was $49.50, NOW **$30**

M 4036 300VA 18V+18V Was $67.50, NOW **$40**

M 4105 300VA 45V+45V Was $67.50, NOW **$40**

M 4120 500VA 30V+30V Was $115, NOW **$79**

M 4145 500VA 55V+55V Was $115, NOW **$79**

M 4155 500VA 65V+65V Was $115, NOW **$79**

1N4004 Diodes

1/2 Price!!

HUGE discounts on general purpose rectifier diodes in packs of 100! Rated at 400V @ 1A. Stock up your parts bin with these popular devices and *save 50%!*

Z 0109 Normally .15¢ each,

NOW **$7.50** per 100

Battery Backup Siren

Incredibly loud 120dB siren with internal battery backup. The brown and white trigger wires are joined to form a "tamper loop", which is connected to a house or car alarm module siren output. If either of the trigger wires or the power wire are cut or disconnected, the siren will sound. Internal batteries can be switched off via a keyswitch on the siren.

Be Quick! 25 ONLY!

S 5208 Normally $55, NOW **$39**

"Easy Start" Jump Starter

Have you ever returned to your car to find a flat battery because you left your lights on? This magic box can have you up and running in about 5 mins without you even lifting your car's bonnet!

Jump start your car without even lifting the bonnet!

One end is plugged into the "good" car's socket, whilst the other end goes into the "flat" car's socket. The "good" car is then started and run for about 5 mins, after which the "flat" car should start. It's clean, easy to use and a lot less intimidating than a sparking set of high current jumper leads. It is also safe for use on EFI equipped cars, (jumper leads can cause expensive damage to engine management systems). Fits in the glove box or under a seat, full instructions included.

A 0295 Normally $39.95, NOW ONLY **$19.95**

LIMITED QUANTITY at this INSANE price!!

Micron Desoldering Tool

Desolders a 14 pin IC in around 30 seconds!

The T 1280 makes it a breeze to remove components from any PCB, even double sided, through-hole plated boards. All it needs is a squeeze or two on the trigger and the component virtually falls out. **Features:** • Totally self contained • Light and compact • Anti static tip • Safe & easy to use • Simple to clean and maintain • Variable tip temperature. The ***Sure Shot*** generates a high speed vacuum every time the trigger is squeezed. This vacuum sucks the molten solder into the collection reservoir of the unit. Here the molten solder solidifies into small particles.

Now over 1500 units in service Australia wide!

Replacement Tips

T 1282 1.0mm Tip $34.95

T 1283 1.6mm Tip $34.95

T 1280 Was $349

NOW **$299**

TERRIFIC BONUS OFFER!

The first 50 callers to purchase a T 1280 receive a T 1274 Bench Stand , valued at *$24.95*, ***FREE!***

The T 1274 keeps your desoldering tool safely upright on your workbench and shields the hot element!

Micron Pro Series Soldering Station

Low voltage iron handpiece for use with Microprocesor or Sensitive Digital Circuits!

Features ceramic element with embedded thermocouple for ultra-fast heat recovery. Ideal for the hobbyist or professional!

The ultimate in controlled temperature hand soldering for hobbyist and professional applications. Features • **Huge 60 watt heavy duty element** • Dial up temperature control with ±1°C stability at idle • Temperature range 250°C to 450°C • Ceramic heater element with embedded thermocouple for ultra-fast heat recovery • Zero voltage switching to minimise voltage spikes at tip • Low voltage element for added safety • Built in sponge tray with tip cleaning sponge • Full range of replacement long-life tips • CMOS-safe grounded tip

BONUS DEAL!

With every Micron soldering station purchased during our sale, we'll throw in a T 1100A roll of solder, and a T 1230 Solder braid twin pack, normally valued at **$13.45** ***FREE!***

T 2441 Normally $199,

NOW ONLY **$149**

LCD Panel Meter

SAVE OVER 20%! Add a hi-tech touch to your power supply, instrument panel etc!

This well designed LCD module will take care of most of your requirements of digital voltmeter displays. Ranges and decimal place options are easily configured by PCB links. Small, compact, reliable and comes complete with plastic surround for a professional finish.

Ranges: .....200mV, 2, 20, 200 1000 VDC

Input Impedance: 10MΩ

Power Supply: .....9V DC

Q 0560 Normally $45, NOW **$25**

300W Inverter

SAVE $50! Fantastic for Farming, Boating, Camping etc.

Connect this to your car or boat battery and presto - instant 240V mains power for electrical appliances. Suitable for drills, lights and power tools etc. Includes an on/off switch and a light & heavy load switch with metered output.

Includes heavy duty battery leads!

M 8120 Normally $249

Now **$199**

1-800 999 007 PERTH (08) 9328 1599

Fax Order Line: (08) 9228 3487

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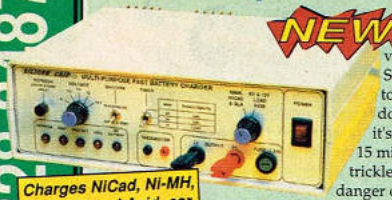
ALTRONICS COMPONENTS

ALTRONICS Fax Order Line: (08) 9328 9187

Multi-Purpose *Fast* Battery Charger Kit

NEW!



Charges NiCad, Ni-MH, Sealed Lead Acid, car and motorcycle batteries up to 4Ah!

A complete battery charger! Using the new, high-tech Philips TEA1102A Battery Management IC, this versatile unit charges NiCad, Nickel Metal Hydride, Sealed Lead Acid, car and motorcycle batteries from 1.2Ah to 4Ah in 6, 7.2, 9.6, 12 and 14.4V terminal voltages. It even does power tool and R/C model battery packs! Best of all, it's super fast, and can charge a 1.2Ah battery pack in just 15 minutes! The batteries are kept topped up using pulse-trickle charging once they're up to full charge, so there's no danger of overcharging your batteries. It also features a refresher for NiCd and NiMH batteries, under and over-temperature cutout, short circuit battery protection, timeout and fuse protection and LED charge indicators.

BEWARE OF INFERIOR KIT SETS! *The Altronics K 1670 is includes a professional instrument case, including fully silk-screened and punched front & rear panels. PLUS, we've specified a low-radiation, high efficiency toroidal mains transformer.*

K 1670 **$199**

New design features the latest Motorola high power output transistors!!

500W Amplifier Module Kit

HUGE 500W! Great for DJ amps, component subwoofers, instrument amplifiers, even PA systems!

What a Beast! 500W into 4Ω!

(See SC Aug '97) Just the thing to power dedicated subwoofers, DJ, PA or party amps or the like. Silicon Chip claims it's the biggest amplifier ever published in a magazine and they'd be right. ***Features*** • 500W RMS into 4 ohms , 278W into 8 ohms (-0.3dB @ 20hz and 20KHz) • Input sensitivity 1.43V (at full power into 8 ohms) • Distortion typical less than 0.01% • Signal to noise 117db unweighted 122db A-weighted • Supplied with the PCB and the components to populate the board, requires a heatsink and power supply ***(requires ±80V DC)***

K 5190 **$230**

12V Halogen Discolight Kit

Great for car shows, sound-offs, shop displays etc! A safe, low voltage light display!

(See SC Jan/Feb '98) Based on the original Silicon chip Discolight, this unit offers the same features as the mains version only with low voltage rails , making it ideal as a school project or to add something different to your car at the next car show or auto salon! Supplied with an attractive case with pre-punched and screened front panel and parts to build and power the unit off 12V DC ***(halogen lamps not supplied)***.

Features: • 4 channels (20W or 50W halogen lamps) • Forward, reverse and auto reversing chaser patterns with music modulation • Simultaneous strobe on all channels • Alternating light patterns • 12V DC or AC operation • Input from loudspeakers, aux level or mic .

K 5807 **$159**

Sustain Unit Kit for Electric Guitars

NEW!

Add sustain to your range of guitar FX at a fraction of the cost of a commercial unit!

(See SC Apr '98) A sustain unit can make your guitar sound a little more "live", by keeping the volume of a note at a constant level while the string resonance dies away. It's one of the most widely used guitar effects (FX), and this simple kit is a fraction of the cost of a commercial unit! It features adjustable attack and decay, a defeat switch and standard 6.35mm input/output jack sockets. Requires a 12V DC power supply. Supplied short form so you can build it into a custom case, if required.

K 5539 **$27.95**

JFET Direct Injection Box Kit

NEW!

A simple, phantom-powered DI box with super low noise JFET mixer!

(See EA Apr '98) DI Boxes allow you to feed the output from a musical instrument directly into an amplifier without using a mic. This new improved DI unit uses a single JFET amplifier, driving a line balancing transformer, and operates from a mixing consoles phantom power system. It has extremely low noise characteristics, high common-mode rejection and wide dynamic range. It features a 6.35mm jack input, a 6.35mm "loop out" for an instrument amplifier, and a balanced 3 pin XLR output for connection to the mixing desk.

K 5552 **$49.50**

Video Fader Kit

NEW!

Add professional wipes & fades to your home videos! Even includes an enhancer to boost the edited signal!

(See EA April '98) Got some home videos you'd like to edit properly for keeps? This useful kit allows you to add basic professional video effects such as horizontal and vertical wipes, fade-ins and fade-outs during your editing. It also includes a built-in switchable signal enhancer so you'll maintain a high picture quality during the process. You'll be surprised just how professional-looking your results can be simply by using this very easy to build kit! Powered by 12VDC plugpack.

K 5875 **$65**

M 9660 12V DC 300mA Plugpack **$13.50**

Cable Break Finder Kit

NEW!

Locate cable breaks in seconds!

(See EA Feb '98) This cable break finder kit allows you to locate the discontinuity in a length of cable without cutting off inch-long sections of cable looking for it! The lead is simply plugged into the unit's sockets, then the dial is rotated until the LED lights. You can then read the location of the break, expressed as a percentage of the cable's length, off the dial. Dead easy! Tests 3 pin XLR, 6.35mm mono and RCA cables. Powered by 9V battery (not included).

K 2571 **$39.95**

Musical Doorbell Kit

NEW!

(See SC Nov '97) A simple little kit that can add a touch of interest to your doorbell! It can be "programmed", by setting resistor values, to play a sequence of nine notes when the doorbell is pushed. Kit includes PCB, components, loudspeaker and pushbutton switch for the door button, or you may like to use your standard door bell switch if you have one already! It's powered by a 9V battery or DC plugpack (not included).

K 1145 **$18.95**

YES! We Now Accept Diner's Club and American Express Cards!!

ALTRONICS

174 Roe St. Perth W.A. 6000
Phone (09) 328 1599, **Fax** (09) 328 3487
MAIL ORDERS C/- P.O. Box 8350
Perth Business Centre, W.A. 6849

Standard Delivery & Packing Charge: $4.00 to 500gms, $5.50 500gms-1 kg, $8.00 1kg-5kg. Where possible we process your order the day received and despatch via Australia Post. Allow approx 9 days from day you post order to when you receive goods.

Overnight Jetservice: Up to 3kg is $9.50, 3kg to 5kg is $16.00—We will process your order the day received (if placed before 2.00PM WST) and despatched for delivery the next day. Country areas please allow an additional 24-48 hours.

Heavy Service: All orders of 10kgs or more must travel Express Road—Please allow up to 7 days for delivery. $12.00 to 10kgs. $15.00 over 10kgs. **Insurance:** As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require insurance cover against loss or damage please add $1.00 per $100 of order value (minimum charge $1). When phone ordering please request "Insurance". **Altronics Resellers:** Chances are there is an Altronics Reseller right near you—check our catalogue list or phone us for details of the nearest dealer. Blue Ribbon Dealers are highlighted with a ●. These dealers generally carry a comprehensive range of Altronic products and kits.

WA - COUNTRY		
ALBANY	BP Electronics ●	(08) 98412681
	Leading Edge Hi-Fi	(08) 98412077
BUNBURY	Leading Edge Hi-Fi	(08) 97216222
BUSSELTON	Mark's Music	(08) 97523522
ESPERANCE	Esperance Comm.	(08) 90713344
KALGOORLIE	Golden Mile Electronics	(08) 90215212
WYALKATCHEM	D & G.J. Pease	(08) 96811132
VIC - CITY	All Electronic Comp.	(03) 96621381
	TECS ●	(03) 96023499
BLACKBURN	TECS ●	(03) 98777071
CHELTENHAM	Talking Electronics	(03) 95842386
CLAYTON	TECS ●	(03) 95629501
COBURG	TECS ●	(03) 93837511
CROYDON	Truscott Electronics ●	(03) 97233860
FOOTSCRAY	G.B. Telespares	(03) 93266035
PRESTON	Preston Electronics ●	(03) 94840191
COUNTRY		
BALLARAT	Wiltronics	(03) 53311947
CRANBOURNE	G & C Communications	(03) 59963298
MILDURA	Truscott Electronics ●	(03) 50238138
QLD - CITY	Delsound PL●	(07) 38396155
WOODRIDGE	David Hall Elect.●	(07) 38082777
COUNTRY		
GLADSTONE	Dtronics	(079) 723960
	Gladstone Elect. Services	(079) 724459
HERVEY BAY	Keller Electronics ●	(071) 283055
MAROOCHYDORE	All Electronic Supplies ●	(054) 436119
MARYBOROUGH	Keller Electronics ●	(071) 214559
TOWNSVILLE	Solex ●	(077) 754522
TAS - CITY		
HOBART	Active Electronics	(03) 62310111
LAUNCESTON	Active Electronics	(03) 63347333
COUNTRY		
WYNYARD	Wynyard Electronics ●	(03) 64424045
NT		
ALICE SPRINGS	Farmer Electronics	(08) 89522388
SA - CITY	Aztronics ●	(08) 82126212
	Force Electronics ●	(08) 82125505
BRIGHTON	Force Electronics ●	(08) 83770512
COL. LIGHT GDNS	Force Electronics ●	(08) 83743346
ENFIELD	Aztronics ●	(08) 83496340
FINDON	Force Electronics ●	(08) 83471188
HOLDEN HILL	Force Electronics ●	(08) 82617088
KENSINGTON PK	Force Electronics ●	(08) 83322299
LONSDALE	Force Electronics ●	(08) 83260901
MONTAGUE FARM	Dynamic Sound Elects	(08) 82624242
SALISBURY	Force Electronics ●	(08) 82830755
NSW - CITY	David Reid Elect. ●	(02) 92671385
SMITHFIELD	Chantronics	(02) 96097218
COUNTRY		
COFFS HARBOUR	Coffs Habour Elect.	(02) 66525684
NEWCASTLE	Novocastrian Elec.Supplies	(02) 49562562
WAGGA WAGGA	Phillips Electronics	(02) 69216558
WARNERS BAY	Vilec Distributors	(02) 49566808
WOLLONGONG	Newtek Electronics ●	(02) 42271620
	Vimcom Electronics	(02) 42284400

1-800 999 007 **PERTH (08) 9328 1599**

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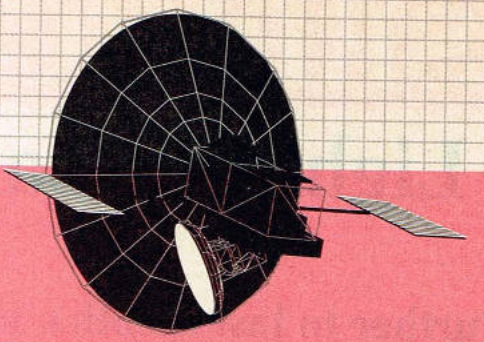
SATELLITE WATCH

Compiled by GARRY CRATT*



New launches: one failure, one success

December 23 saw the failure of Asiasat 3 to achieve geostationary orbit, despite an initial successful launch aboard a Proton rocket from the Baikonur Cosmodrome in Kazakhstan. Unfortunately, the fourth stage booster failed some six hours later, leaving the satellite stranded in a low Earth orbit from which it will gradually descend into the atmosphere and burn up. Asiasat has a contingency plan to launch a replacement satellite by early 1999.

Meanwhile Intelsat 804 was successfully launched aboard Ariane 42L. Tracking, telemetry and command monitoring was acquired some 45 minutes after launch by the Intelsat earth station in Perth.

The satellite has 38 C band and 6 K band transponders and is expected to commence commercial service from 64°E longitude by the time this column appears. The high power of some of the C band transponders means receiving dishes as small as 1.8m may be used for some of the video services offered.

Optus B1/B3 status

As some readers will know, Western Australian broadcaster GWN has operated a BMAC service on Optus B3 for many years. Recently, GWN decided to move to PAS-2 and convert to digital format. Their digital signal is now running on PAS-2 and they will turn off their Optus B3 BMAC service at the end of February 1998. In addition, the ABC say that they will convert to (different) digital format in May 1998 and will continue to operate on the Optus B3 satellite.

This means a WA viewer may need two dishes and two different digital receivers to continue receiving both services. The Federal Government has offered a $750 subsidy towards the purchase of a digital decoder for "replacing an eligible BMAC receiver".

The new GWN service on PAS-2 is to be jointly maintained by GWN and Telstra (who own the uplink equipment). They have also now decided to carry the ABC (at slightly lower quality) on PAS-2 to avoid the need for WA viewers to buy a second dish. This ABC service will include the full suite of ABC radio services. Telstra will also carry SBS in WA time on PAS-2.

The new Aurora platform carried by Optus on its B3 satellite will include the ABC and SBS, both of higher quality than that carried on PAS-2 due to more available bandwidth. In addition, Optus has stated that they will provide a GWN service at a lower but acceptable (quality) data rate. GWN has not agreed to this.

Aurora is also expected to carry the WA government's educational and training talkback service "Westlink", as well as a national educational channel "Horizon". Aurora approved decoders will be available early this year.

Intelsat 701 (180°E)

Several viewers have advised receiving Network 10 feeds on 3764MHz RHCP in MPEG with SR (symbol rate) 29,895 and FEC (forward error correction) 7/8. The Sports Pacific Network (SPN) has also begun operation on this satellite. Digital parameters are SR 4730, FEC 3/4, RHCP polarisation.

The Sports Pacific Network (SPN) has commenced operation on Intelsat 701.

This is a free-to-air service, funded by advertising.

Asiasat 2 (100.5°E)

A new addition to this satellite is Laos TV, a digital service operating in PAL format at 4143MHz, horizontal polarity, SR 2889, FEC 2/3. Another addition is Star News Channel, apparently created to cover the Indian national election. The service operates free-to-air in analog on 3740MHz and with vertical polarisation.

Panamsat 2 (169°E)

Several new digital channels appeared on this satellite on January 15th, including a 6-channel bouquet labelled "Napa feeds" on 3942MHz, horizontal polarity, SR 6620, FEC 2/3. There was also a single digital channel identifying as ITJ Tokyo, on 4174MHz horizontal polarity, SR 5632, FEC 3/4.

* Garry Cratt is Managing Director of AvComm Pty Ltd, suppliers of satellite TV reception systems. Phone (02) 9949 7417. http://www.avcomm.com.au

SERVICEMAN'S LOG

Lightning can cause strange faults

Further to last month's story on lightning damage, another one comes to mind, along with a story about of a couple of VCRs and a service manual that went walkabout.

First, another lightning story. Mr Knight's wife was in the living room looking out the window at the never-ending sheets of rain when there was an unbelievably deafening crack as lightning struck about 100 metres down the street.

Everything electrical went off and then the lights slowly came back on. The initial shock of being so close to so much power cannot be understated and one is always amazed when people are actually struck by lightning and survive! I suppose the immediate physical effect is the deafness from such a loud noise plus the intensity of the flash, which may cause temporary blindness. However, these effects wear off and you begin to weigh up the cost of the damage inevitably inflicted by nature's fury.

In Mr and Mrs Knight's case, the telephone was dead, as were some of the house lights and appliances. The outside light proximity sensor switch had also gone. And all the neighbours suffered multiple failures.

The TV set, a Panasonic TC-29V50A (MX-2A chassis), had been on at the time but, as soon as the lightning hit, reverted to standby mode. As I later learned, the remote control restored the picture perfectly but there was no sound.

Because the phone had been knocked out, Mr Knight had to drive to my shop to arrange for me to fix the set. I showed up that afternoon, intrigued as to why only the sound had failed. I suspected that, in the confusion after the strike, someone may have pressed the wrong buttons on the set or the remote control. However, after spending 10 minutes checking all the controls, only faint clicking noises could be head in the speakers.

I didn't have a circuit for the set and, as it was another large model, I was reluctant to move it to the workshop – as was Mr Knight. I hoped that a temporary fix could be organised until I could better prepare myself.

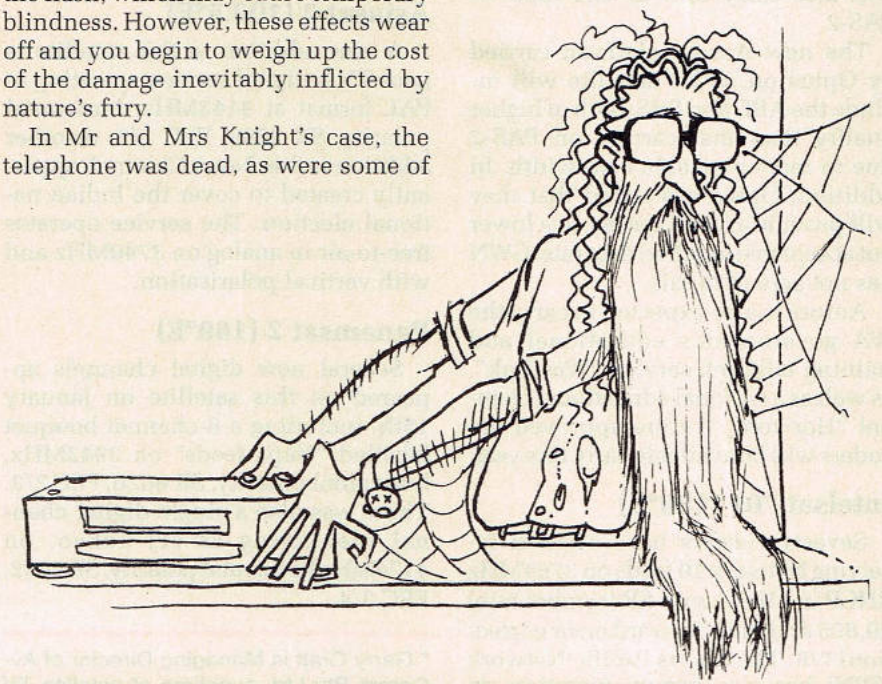
First, I tried feeding in signals from their VCR but as expected, there was still no sound. However, the TV set on-screen displays showed that the set's stereo decoder was working and could distinguish between mono signals from the VCR and stereo off-air transmissions.

Next, I decided to try feeding the AV (audio/video) outputs from the VCR directly to the AV inputs of the TV set. I fetched some RCA leads from the truck, connected the two machines together and selected the AV mode. As before, the picture was fine but there was still no sound. This could only mean that the problem lay somewhere in the audio amplifier stage.

I took the back off and, by tracing the speaker connections, established that IC2303 (AN7169) was the stereo output amplifier. Rubbing my fingers over the solder produced hissing noises from each channel. Although not a definitive test, it did suggest, even without the benefit of a circuit diagram, that the fault lay between the input AV sockets and this chip – possibly in the volume control and mute circuits.

Fortunately, the family had a portable radio/cassette player with line inputs for recording. By connecting it to the audio output sockets on the TV set and pressing the cassette record buttons, I was able to hear sound from the TV set at last.

I decided to leave things set up in



this manner while I ordered a circuit diagram. The only inconvenience the family had with this arrangement was that they had to physically adjust the volume control on the cassette player to the level they preferred, as the remote control had no effect. And of course, the cassette player had to be switched on and left permanently in the record mode.

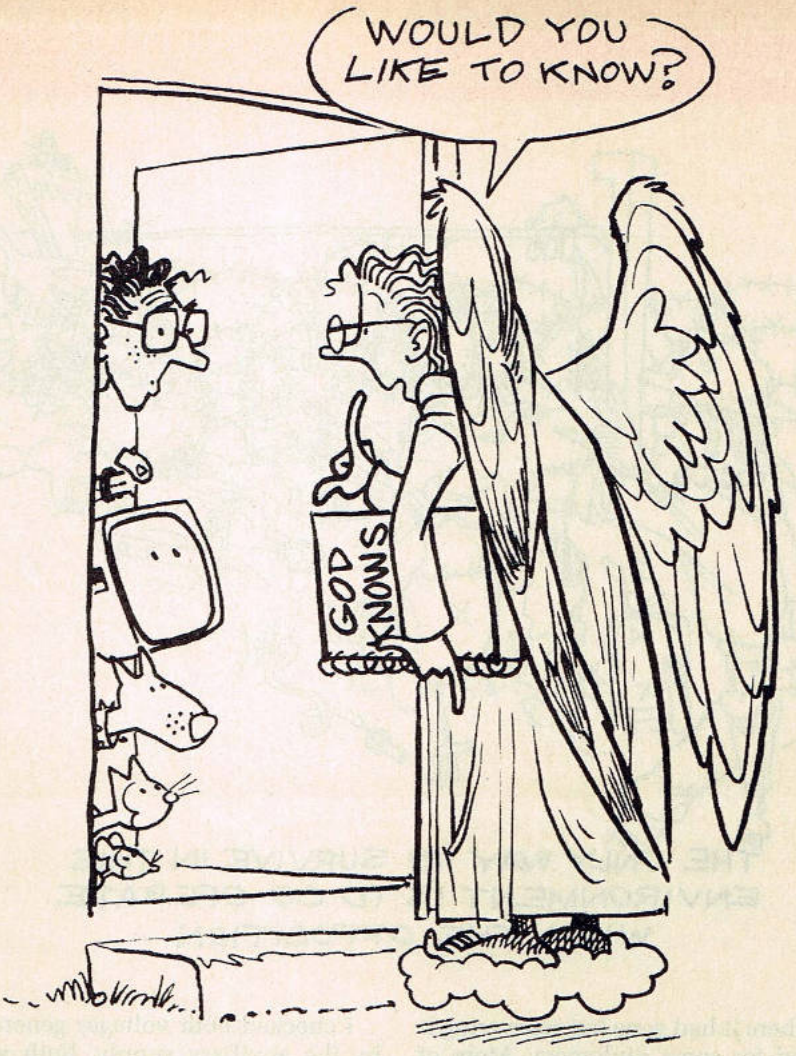
I received the circuit about one week later, only to find that there were no less than seven ICs involved with the sound circuits (not to mention the muting and control processors). These were: sound IF IC2206, stereo decoder IC2201, AV control IC3001, surround sound IC2301, audio control IC2302, preamp IC2306 and output amplifier IC2303. The audio muting, simply put, was controlled by IC1102 to Q2301 and Q2302, as well as Q3015, Q3016 and other circuits, such as Q1113 audio defeat and Q1111 volume.

As my provisional sortie had already eliminated half of these, I decided to take a signal tracer (a little battery-powered amplifier) and a signal generator on my next trip. Mr Knight was delighted to see me back but exasperated to learn that I still didn't know where the problem was and that I was only there to attempt to identify the faulty part(s). After all, this was just a simple sound failure – at least, as far as he was concerned.

Selecting the left channel and using the tracer, I managed to monitor sound from pin 5 of AV control IC3001 (pin 1 was for the AV OUT) to pin 8 of surround sound IC2301. There was also sound from pin 3 of IC2301 to pin 6 of preamp IC2306 and from pin 7 to pin 3 of audio control IC2302. But there was nothing from pin 9 of IC2302 to pin 2 of output amplifier IC2303.

I unsoldered the collector of Q2301 to ensure that the muting circuit wasn't doing its thing but there was still no sound. So, by a process of elimination, the fault had to be in IC2302, a CXA1279AS, and/or its control circuits. A meter check established that the control voltage to pin 16 varied with the volume control, which was correct.

I felt I had to be pretty certain as to which part to order, as Mr Knight was becoming rather "tetchy" about the speed of this "simple" repair. To be safe, I decided the best course was to order the IC chipset in case of a misdiagnosis. If nothing else, I would have them in stock for what is a fairly popular model.



~THIS IS ONE ASPECT OF THE JOB I DON'T HAVE THE MEANS TO EXPLAIN ...PERHAPS NO MORTAL CAN

Anyway, as luck would have it and to my great relief, my diagnosis was spot on – replacing IC2302 fixed the problem and restored the sound completely.

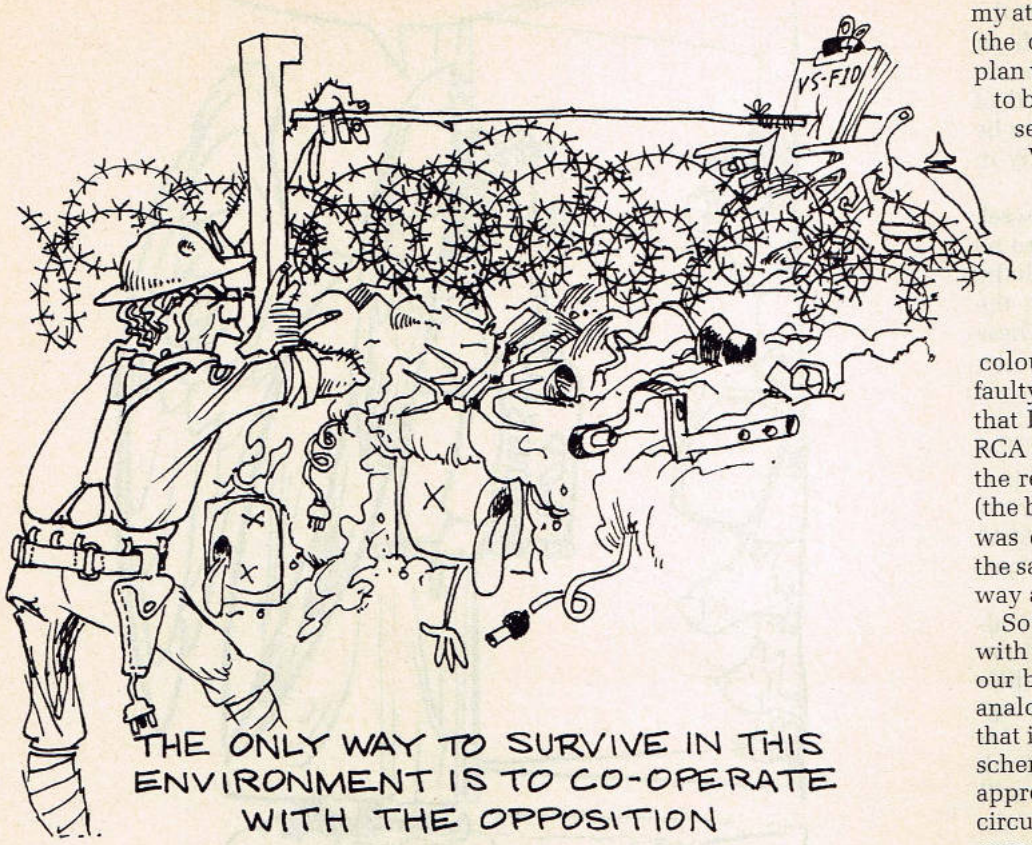
But why, in the multitude of components in this TV set (there are 25 ICs in all), did the lightning destroy only this IC and nothing else? Unfortunately, this is one aspect of the job I am not qualified in so I don't have the means to explain it. Perhaps no mortal can!

A tale of two VCRs

My next story is about two VCRs, both Akai VS-F10EA models. This model VCR is old by present day standards but is a reliable performer and a popular choice as a rental unit. And this is the story of two such rental units which landed in the workshop together.

To minimise confusion, I have designated them as VCR 1 and VCR 2. Mr Carton's set was VCR 1 and the symptoms were no video on playback or even AV in or out. Mr Darnay's set was VCR 2 and the symptoms were described as intermittent stopping when playing back. But by the time I tried it, it was completely dead.

These units presented a major problem; I had no circuit. Originally, I did have a complete manual but this had gone walkabout. I had a good idea as



to where it had gone but recovering it called for some diplomacy. More of that later but, for now, I was trying to manage with a slightly different circuit, namely for a VS-F16. Though close, this was still significantly different in parts and led me to doubt conclusions I had made on the basis of this schematic.

Mr Darnay's set, VCR 2, was the more urgent so I tackled it first. This model VCR features two power supplies: (1) a main switchmode power supply which provides seven rails (23V, 16V, 3 x 12V and 2 x 5V); and (2) an auxiliary miniature switchmode power supply on the motherboard which generates a -35V rail and a 5V rail, the latter called a "filament" supply for the display system. The auxiliary supply operates from the 23V rail.

I checked all seven voltage rails at the output plug (WP201) of the main power supply. There were voltages on all seven, though not exactly correct. However. I often find that Akai's marked voltages are not necessarily exact, often contradicting themselves on various parts of the circuit.

I checked both voltages generated by the auxiliary supply. Both were present but somewhat low. The question was the degree of error and what was critical. The 5V rail was less than 4.5V, while the -35V was down to -27V.

Akai service bulletins warn that low or dark displays may be due to two electros drying out in the auxiliary power supply. I decided to replace C446 and C447 with two 100µF electros (they are marked 47µF in the circuit diagram but 120µF had already been fitted by the factory). It was a futile gesture which made no real difference.

I next checked all the crystal clocks with an oscilloscope, especially X701 (4.43MHz) on the video board. This also supplies a clock signal (fsc) to the digital servo (IV401, pin 22) on the motherboard. Everything seemed OK.

My next step was to see if the loading motor mechanism was aligned correctly but as expected, I could find nothing wrong here (after all, when it worked, all functions worked properly). By now, I was coming around to the idea that either a microprocessor or the servo itself was intermittent.

At this point, I decided to switch my attention to Mr Carton's set, VCR 1 (the one with no video input). The plan was to tackle what now appeared to be the simpler fault, then use this set as a donor to fix the problem in VCR 2. The latter could then be returned, while VCR 1 could wait for parts to be ordered and installed (I hope all this makes sense).

Because the fault was lack of video, I decided to work with a colour bar generator rather than risk a faulty tuner. The only problem was that I stupidly plugged the generator RCA plug into the wrong socket on the rear panel, namely the audio out (the back was facing away from me, it was dark and the sockets all looked the same – well, that's my excuse anyway and I'm sticking to it).

So, following the colour bar signal with the CRO, I tried tracing the colour bars to pin 1 of IC101, a TC4066 analog switching IC. When I found that it never reached it, as the VS-F16 schematic showed, I abandoned this approach and assumed the VS-F16 circuit differed from the VS-F10. However, I did find a video signal on pins 2 and 4 of IC101.

I followed this video signal all over the motherboard to pin 5 of IC602 (AN3247K) and out again on pin 9 to pin 13 of character control IC102. And that's where the trail went cold, with no signal out from pin 12 to the video output. It looked as though IC102 was the culprit and so, to confirm this, I momentarily shorted pins 12 and 13 together and the picture was restored. Of course, it was possible that the fault could still be external to the IC.

But I was happy to accept that it was the IC and so I desoldered the corresponding IC from VCR 2 and donated it to VCR 1. Success – well, sort of; the picture was fine but there was a buzz in the sound and I still had to solve the mystery of no video in.

The missing manual

At this point, it is appropriate to reintroduce the subplot of the VS-F10EA service manual which had gone walkabout and detail the history and order of events.

Being a small service organisation, it is impossible to stock all circuits for all models, especially as new ranges

appear about every five months from every manufacturer. The only way to survive in this environment is to co-operate with the opposition – you lend me your manuals and I'll lend you mine. Normally, this arrangement works well but occasionally, when you deal with a large service centre where there are many people involved, manuals can get lost.

And so it was with my VS-F10EA manual – I lent it to this centre about six months ago but they didn't return it. When I reminded them, they didn't think that they had ever borrowed it. Anyway, I didn't want to alienate them by pressing the point too strongly and simply assumed that it would eventually turn up and be returned.

As it turned out, my luck was with me. I called into the centre recently to borrow some other circuits and on the spur of the moment I asked if I could borrow their VS-F10 service manual. Obligingly, the technician went to the filing cabinets and pulled it out, only to discover that it was my copy with my writing all over it!

The technician was most apologetic and so I departed, much relieved at recovering my lost manual. And none too soon, because I was still puzzling over the buzz in the sound and the confusion over the RCA sockets and the colour bar generator. Fortunately, it didn't take long to realise my error and sort out the confusion.

So, with VCR 1 working properly at last, it was now reassigned as a donor and I could swap parts out of it and into VCR 2. The first step, of course, was to refit IC101 into VCR 2 (I know it sounds silly but that was the way it had to be). This done, I swapped the entire front panel with the timer microprocessor and display on it. I thought I had correctly diagnosed this too but it wasn't long before it started to fail intermittently and ultimately failed completely.

Next, I swapped IC403 (syscon), which means desoldering and resoldering 64 pins twice over. Once again, it started to work and then died. I was becoming rather dispirited but decided to swap the digital servo IC (IC401). This had exactly the same effect as before and so I put the machine aside and waited for inspiration.

While I was catching up with routine work, I kept thinking about the symptoms of this rogue set. More often than not, it worked when cold rather than hot or failed after it had been on for a while. So why not try the freezer treatment?

To cut a long story short, I expended an expensive can of freezer and achieved nothing. Well, not quite; there was some momentary activity in the power supply, which made me put my thinking cap on again. Perhaps some of these voltage rails were more critical than others but the question was, which ones?

It was at this time that I had the chance to talk again to my mate from the opposition. He was very familiar with Akai VCRs and told me the 23V rail from the main power supply was the one to watch and if it was down to 19V to change the bridge rectifier (D1, D2, D3 & D4). This was the lead I needed and when I measured it, it read only 20.5V.

Unfortunately, replacing the diodes made no difference and so I decided to check the main filter electro (C3). Why not connect another electro across C3 and see if that made any difference? To my delight and surprise, it fixed the problem completely. I replaced C3 (2200µF 35V) with a new one and reassembled the VCR. It was now working perfectly.

I left all the good parts in VCR2 and put VCR1 aside to wait for the new IC101 to be delivered.

And so it all ended happily – for the customers. But in retrospect, I didn't come out of it particularly well, either financially or technically. I had missed the obvious; ie, the need to follow up any suggestion of a power supply fault.

My only excuse is that I got sidetracked by the need to work (initially) with a substitute circuit, an apparently intermittent fault and by my confusion over the voltage values. Still, I should have known better and I do know better. I simply didn't follow the rules and paid the price.

The flea-marker computer

To finish up, here is a story on a brighter note. It comes from a reader and was inspired in part by these notes in the December 1997 issue, describing a service job on an AST Ascentia Colour Notebook computer. It comes from a VK5 amateur, S. M. of Elizabeth Downs, South Australia, describing a tentative approach to laptop computer servicing. This is how he tells it.

It all started when my 14-year old stepson, Peter (not his real name), at high school and up to his ears in computers, wanted to visit the local computer flea market. My wife said OK; she hoped she might get some clip art for her craft hobby, while Peter might get a CD ROM or some more SIMMs.

The place was chock-a-block when we arrived. There were trestles sagging with games, programs, old computers, VDUs; you name it, it was there. After it had thinned out a little

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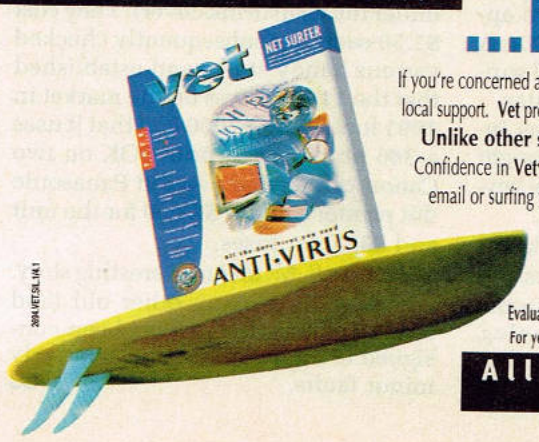

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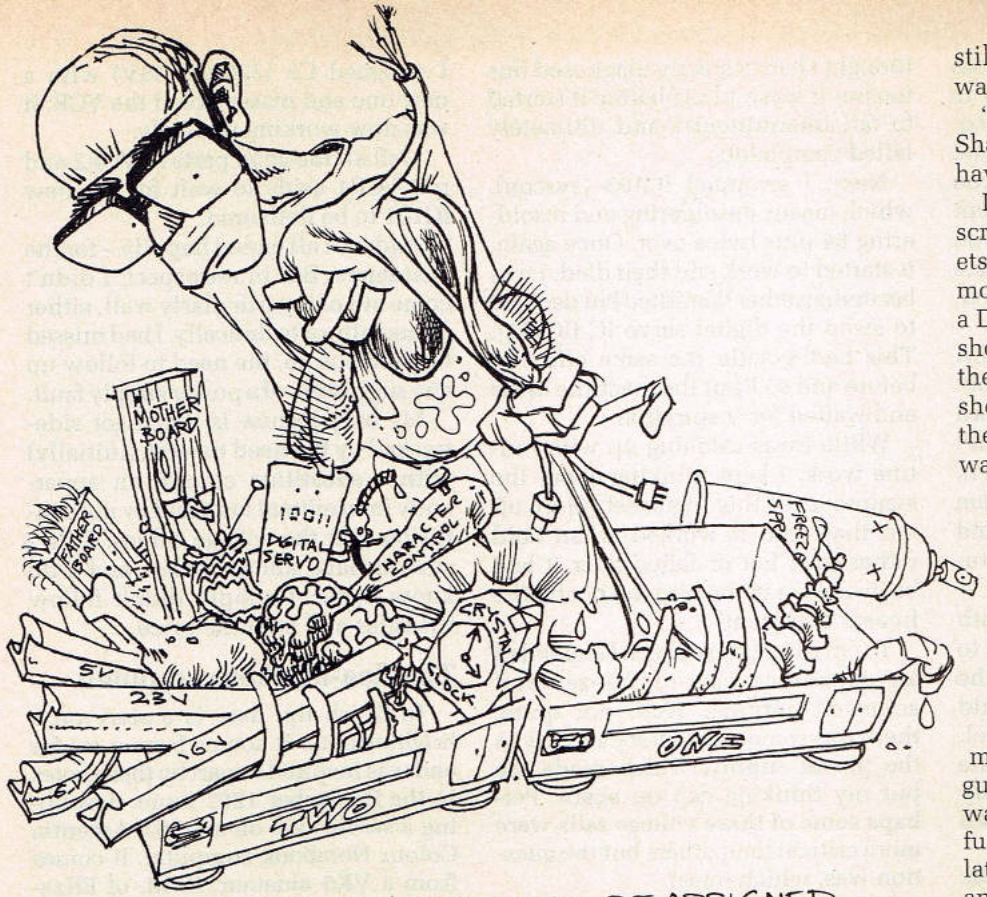

VCR 1 WAS NOW RE-ASSIGNED AS A DONOR...

I wandered around and saw a chap offering a laptop. A notice on it said, "A Mr Fixit Special".

It was a Tandy 1100HD with an LCD green screen, a 20Mb hard disc drive, a 3.5in floppy disc drive and MS DOS version 5. It included two batteries (one of them new) and all manuals and discs. The notice said, "power supply will not operate the PC, or charge the battery". He wanted $45.00 for it.

I pointed it out to Peter. With a gleam in his eye he asked, "Do you think you can fix it?" I asked the vendor if I could have look at the instruction book. "Yes, go ahead", he said. "It just won't run, that's why I bought a new battery".

The book indicated a 6V battery, and the external power supply unit (PSU) was 9.5V at 1.2A. This went into the computer via a standard DC connector, similar to most plugpack PSUs. I said to Peter, "If it's the PSU, I could easily make a new one".

By this time my wife had taken some interest in it. And, in answer to Peter's unspoken question, replied, "Yes", and handed him the money. We wandered around a bit, then headed for home.

On the way, my wife and I called in at a delicatessen, leaving Peter in the car. When we came out, Peter could not contain his excitement. "It works, it works! I connected the second battery, turned it on, the 'Charge Light' blinked, the display came up with a start-up routine, and the beeper beeped. Then it died".

When we arrived home Peter wanted to fix everything straight away. I persuaded him put the battery on charge while we had lunch. With the battery removed and a couple of makeshift pins in the battery plug, we applied 7.5V across the battery at 500mA from a constant current regulated supply and left it for about 45 minutes.

When the charged battery was installed, the computer fired up straight away. Peter's fingers flew over the keyboard. Everything appeared OK.

"Right", I said, "let's check the PSU". I plugged it into the mains and switched on. There was no smoke and the DVM indicated 10V DC at the plug. A 12V 3W festoon lamp lit up when connected across the plug, with 9.2V still indicated on the meter. So it wasn't the PSU.

"Ah", I said to Peter, "Are you game. Shall we take it apart?" "Yes; what have we to lose?"

It took us 10 minutes to undo all the screws and the little plugs and sockets, after which we were able to remove the covers. Continuity tests with a DVM and a DC plug with test wires showed that the switching action of the DC socket was OK. Further checks showed that the DC was applied to the PC board and that the battery plug was connected to the board.

So what was wrong? I was inspecting the board for burnt or damaged components when I spied four miniature fuses marked F1, F2, F3 & F4, each about the size of a 0.25W resistor. A quick check with the DVM revealed that F2 (2.5A) was OC.

I decided to use one strand of multi-strand hookup wire which I guessed would fuse at about 2A. This was soldered to one end of the dodgy fuse and a short piece of plastic insulation slipped over it (in case it blew and splattered everywhere). The other end was then soldered to the other end of the fuse and a DVM used to confirm that it was intact.

It took us a careful 15 minutes to get it all back together again, with all the right screws and bits in the right places. No wonder computer techs charge $50-$60 just to look at a repair. With it all back together we tried it on the battery first. It worked OK. We took the battery out and tried it on the PSU – OK again. We then reinstalled the battery and the battery charge light came on, so all functions were OK. Peter couldn't get inside quickly enough to show his Mum.

I obtained two spare fuses, one for the computer and a 4A one for the other battery pack (a miniature one under the heatshrink cover). They cost $1.50 each. We subsequently checked various Tandy stores and established that the 1100HD was on the market in 1991 for around $2000 and that it uses a 386 processor. It prints OK on two Canon printers and an old Panasonic dot printer – all for $45.00 for the unit and $3.00 for fuses.

Thanks S. M. for an interesting story. I wonder how many other old (and not-so-old) machines have been consigned to the scrap heap for relatively minor faults. **SC**

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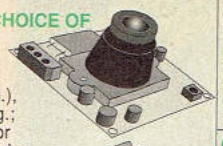

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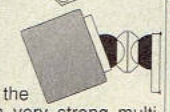

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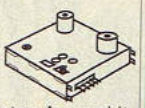

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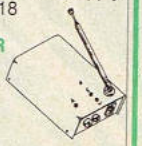

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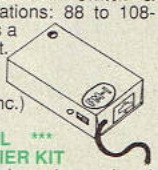

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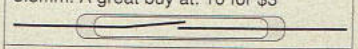

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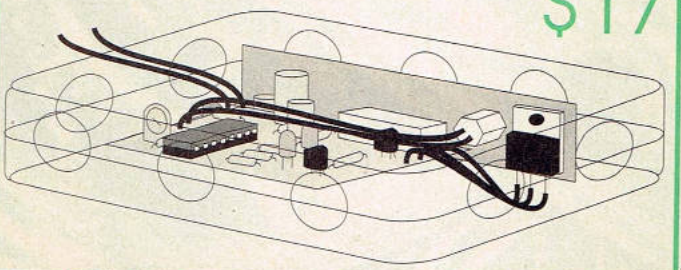
Suitable surplus transformer **(Mains wiring experience necessary!!)** $9

$17



THE NEXT MONTHS FEATURE KIT

Professional quality 2/3/4 Ch. (select.) sequential A/V switcher. Includes a VCR Rec./Stop switch (relays) which can be used with standard PIR detectors. Has provision for UHF A/V mixer amp.: Add a security channel into your existing TV system. Low cost! $60... $18 Extra for the mixer/amp...

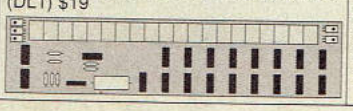
NETWORK 2 COMPUTERS FOR $50!!
New Windows/95 compatible (DEC (DE101) etherworks LC/TP) DIGITAL brand Ethernet computer cards with software and booklet in original box. Cards include boot ROM so one of the computers does not even require a hard disc. We don't supply the commonly available cable which can also be made up with RJ45 connectors and two twisted wire pairs: Diagram included. Limited quantity: $50 for a pair.

CGA COLOUR MONITOR
New 12V DC-1A 6" colour monitor, ready for enclosing, no box, just the tube and driver PCB's Down from $69 now just a low $40

DC MOTOR SPEED CONTROL EXPERIMENTERS PACK
ONE 20A motor speed controller kit (similar to SC - Jun.97-$18) plus two small new 12VDC motors (40mm dia., 40mm length) plus one used car windscreen wiper motor (which have internal gear reduction) for: $32

OPTICAL TACHOMETER KIT
Measures RPM of prop. shafts etc. without physical contact. similar to the kit published in SC. (May 1988), but includes X-tal control calibrator. Use a DMM on 200mV or a 3 1/2 digit panel meter as the display PCB + all on-board components: $25.

MOVING MESSAGE DISPLAY PCB:
Used, complete assy. with 20 bright 5x7 **(Alltogether 700 LEDs.)** matrix red LED displays and driver. Inc. twenty 74HC164 ICs. Display size is 280 x 18mm LED's, PCB 330 x 75mm. Needs external 5V supply. Inc. a simple program on disk and instructions to scroll No "1" through all displays, via a computer parallel port. Limited quantity: (DL1) $19



AUTOMATIC LASER LIGHT SHOW KIT
The changes every 5-60 sec, adjustable. Countless displays single to multiple flowers, collapsing circles, rotating single & multi ellipses, stars, etc. PCB + all PCB components, three motors & mirrors : $65 Or with above kit for $79!!

******SPECIAL***SPECIAL***SPECIAL*** ELECTRONIC KEY KIT:**
An AX5326 IC + other parts on a small PCB, When touched against the decoder terminals, switches on-board 12A N/O-N/C relays. One momentary relay for car indicators or buzzer etc. The other can toggle or momentarily switch electric door strikers, car alarms, central locking, Many high security uses. Has no key battery, it's power is derived from the decoder. It's **IMPOSSIBLE** to determine code from decoder terminals, Safer than keypad locks. Over 500,000 personalised codes. 10-15V. RX PCB: 140 x 66mm. "Key" PCB is 50 x 30mm. Kit With 2 keys:$30

STEREO FM TRANSMITTER KIT:
88-108MHz, 6-12V DC, 8mA @ 9V, 25 x 65mm PCB size, PCB plus all on-board components, plus battery connector and 2 electret microphones. (K94) $25

*** SPECIAL ***
GRAB THEM BEFORE THEY GO!!!
STILL THE BEST LASER LIGHT FOR HOLIGRAPHY ETC. HELIUM - NEON LASER TUBE & POTTED SUPPLY:
Large 2-3mW laser head + compact potted US made power supply. Head plugs into the supply & connect to 240Vac.. Bargain: $65
WARNING!!! VERY BRIGHT NOT FOR USE BY CHILDREN!!! ALL LASERS SHOULD BE USED UNDER COMPETENT SUPERVISION.

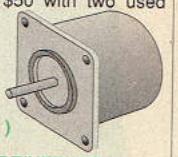
SOLID STATE "12V PELTIER EFFECT" COOLER/HEATER
We supply Peltier Effect device, a (G02) 12V DC Fan & inc. diagram & a circuit for a small fridge / heater. Other items required; A insulated container ie. an "Esky", 2 large heatsinks, & a small aluminium block. device draws 4.5A @ 12V and is 40 x 40 x 4mm. This device is used in the common 15 litre car fridge. 4.5A Device plus (G02) 12V DC Fan:(G11) $35. Device only:(G13) $27

UV MONEY DETECTOR: .....NEW!!
Pocket source of UV. Used for checking for forged bank notes. (Australian bank note serial numbers fluoresce under UV. light) Also used in the gem industry. Uses 2 x AA batteries to power a very simple inverter with a cold cathode UV tube 50mm long.The Inverter section could be used for experiments For example, it can be used to light up a 4W fluorescent tube for a dim white light source. Current consumption of unit is about 250mA. Case size 82 x 46 x 21mm: $6

MORE KITS
Geiger counter:$40,...Breath tester: $40,..Music box: $11,..Ding dong doorbell: $3.50, Siren using a 10cm speaker: $14,..Electric fence using used car coil: $25,..Ultrasonic car alarm: $35,..1ch UHF Central locking, Tx and Rx: $35,...4 door Central locking: $60,..2 Channel UHF Remote Control, 1Tx + 1Rx: $45.

COMMAND CONTROL FOR MODEL TRAINS. Control up to 16 trains on one layout with very little wiring!: As per SILICON CHIP Jan-May 98. We have some hard to get ZN409CE IC's. We will also be supplying silk screened and solder masked PCB's & special parts for this kit. all at good prices!!

****** TWO GREAT SPECIALS ******
*****STEPPER MOTOR DRIVER KITS*****
NEW!!! COMPUTER CONTROLLED STEPPER MOTOR KIT New improved kit that can drive larger motors and has optoisolation between the circuit and the computer. DB25 connector provided on PCB. Needs a standard DB25 cable for connection to a PC, and a power supply for the motor drive section. PCB and all on board components kit plus software and notes: $40 or $50 with two used 1.8deg. motors !!!
(ONE ONLY NEW MOTOR OF SIMILAR QUALITY TO THE ONE SUPPLIED COSTS OVER $100)



STEPPER MOTOR DRIVER KIT
Kit includes a large used 1.8deg. (200 step / rev) motor & uses SAA1042A IC. **(ONE OF THESE CHIPS WOULD RETAIL FOR ALMOST $19)** Can be driven by external or an on-board clock; has a variable frequency clock generator. Ext switches (not inc) or logic levels from a computer etc set CW or CCW rotation, half or full step operation, operation enable/disable, clock speed. PCB and onboard components:$20 with 1 motor, $30 with 2 motors.

FLUORESCENT LIGHT HIGH FREQUENCY BALLASTS: European made, new., "slim line" cased high frequency (HF) electronic ballasts. They have flicker free starting, long tube life, high efficiency, no flicker during operation, reduced strobing with rotating machinery, no audible noise & generate much less radio interference than conventional ballasts. The design appears to be similar to that published in the Oct. 94 SC. in that a HF sine wave is used, but more complex. Some have a dimming option, requires either an external 100K pot or a 0-10V DC source. Some require the use of a separate filter choke that is supplied where req. Limited stock of new price!
Type G09E 2x32W-40W tubes, not dimmable, no filter, 44 x 4 x 3.5 cm: $18
Type G09H 1x32W-40W tube. dimmabe, filter used, 44 x 4 x 3.5cm: $14

OATLEY ELECTRONICS
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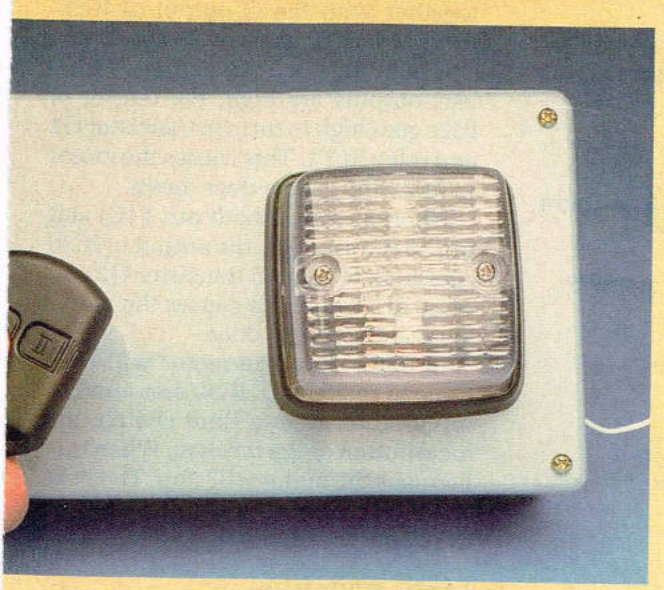
Ph (02) 9584 3563 Fax 9584 3561
orders by e-mail: oatley@world.net
http://www.ozemail.com.au/~oatley
major cards with ph. & fax orders,
Post & Pack typically $6

The drive system for this garage door opener is based on a standard 12V windscreen wiper motor and a standard bike chain and sprockets. It raises or lowers the garage door fully within about 12-13 seconds and is powered by a 12V battery which is kept on permanent trickle charge. Note that a chain guard should be fitted, as a safety measure.



How would you like to be able to drive straight into your garage without the hassle of having to get out of the car to open the door? Well, now you can have a remote-controlled garage door opener without having to pay big dollars.

Do-it-yourself automatic garage door opener; Pt.1

Design by RICK WALTERS

ALMOST EVERYONE who has a car and a garage wants an automatic garage door opener. After all, who wants to get out of the car each time the garage door has to be opened or closed. As one of those fortunate people who now has an automatic garage door (this one), I can tell you it is bliss. You just roll up to the garage and drive right in, the door having just rolled up before you enter. And that's on a fine sunny day.

On a cold, wet winter's night it is even better. Again, you just roll up to the garage and drive straight in. What more could you want?

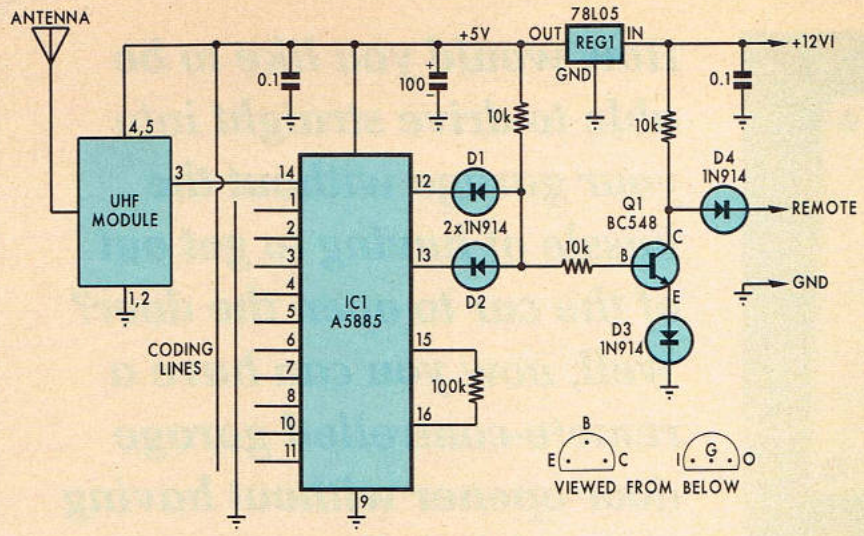
Problem is, automatic garage door openers are not cheap. Well, they're not when you have a commercial unit installed but if you build your own you can save a bundle.

The design presented here will drive a typical single (2.4m wide) roller door. It uses a 12V windscreen wiper motor and a bicycle chain as the drive system. Running from a 12V battery, it is proof against power blackouts too, something which cannot be said about most commercial door openers.

Let's just briefly describe the drive system. A standard 46-tooth pedal sprocket from a bicycle (approximately 190mm in diameter) is attached to the roller door drum spider. This is connected by chain to the 12V windscreen wiper motor which drives a standard 15-tooth rear wheel sprocket (62mm diameter).

Since the wiper motor has a worm gear drive it automatically locks the door in place when it is closed, giving good security.

As with a commercial door opener, the wiper motor operates the door quite slowly, taking about 12 seconds to open or close the door. It doesn't need to be any faster than this. If it was faster, the motor would need to be much more powerful and there would always be the risk of injury from a faster moving door. How could you be injured by a fast-moving garage door? Well, if you're trying to escape from the garage before the door



AUTODOOR REMOTE CONTROL

Fig.1: the circuit of the UHF receiver board. It uses a fully built UHF receiver module and this drives an A5885 trinary decoder.

comes down, it is quite easy.

The door is operated by a UHF remote control system and uses a standard keyring transmitter. The UHF receiver and motor drive circuitry is housed in a plastic case and this has a 12V light on it to illuminate the garage at night, after the car's headlights are switched off. It turns off five minutes after the door is operated. There is also a "local" switch inside the garage itself so that the door can be raised or lowered without using the UHF keyring transmitter.

So there you are. It offers all the features of a commercial door opener but you can build it yourself. Before we get to the mechanical details, let's have a look at the circuitry involved.

UHF remote control

As already noted, the door opener is operated by a UHF remote control system. It uses a standard UHF keyring transmitter operating at 304MHz. This is supplied assembled and tested so there is no work on that score.

Fig.1 shows the circuit of the UHF receiver and decoder while Fig.2 shows the circuit of the motor drive electronics.

What we haven't shown is the circuit of the keyring transmitter. This is the same as that featured for remote central locking for cars, in the October 1997 issue of SILICON CHIP. This produces coded 100kHz bursts at 304MHz each time one of the two buttons is pressed.

The UHF receiver and decoder has two principal parts. First, there is the UHF receiver itself which is a tiny fully-assembled and tested PC board. Its detector output feeds the 100kHz bursts to the input of IC1, an A5885 trinary decoder. As its name suggests, the trinary decoder looks for a valid code and when it receives it, one of its outputs at pins 12 and 13 goes low.

So that either button on the transmitter can be pressed to raise or lower the door, we use both decoded outputs on the A5885 and these are ORed together by the diodes connected to the base of transistor Q1. When either pin 12 or pin 13 goes low, the collector of Q1 goes high and this signal is fed to the receiver input on the motor electronics board – see Fig.2.

When the receiver is actuated by its remote control or when the LOCAL switch S3 is operated (inside the garage), the output of OR gate IC3b goes high, and this causes the output of IC2d to go high as well. IC2 is a 4081 quad AND gate package but IC2a and IC2d are merely used as non-inverting buffer stages.

Anyway, the high signal from IC2d resets the 4060 timer IC5 and also is fed to the clock inputs of the 4027 dual JK flipflop IC1. The high signal clocks IC1a and if pin 10 (the J input) is high, IC1b will also be clocked.

The Q and Q-bar outputs of IC1a, together with the Q output of IC1b, drive two AND gates, IC2b and IC2c.

If both the pin 1 (Q) and pin 14 (Q-bar) outputs are high, the output of IC2c goes high to turn on transistor Q1 and relay RLY1. This causes the motor to drive the garage door down.

Alternatively, if both pin 1 (Q) and pin 15 (Q) are high, the output of IC2b goes high to turn on transistor Q2 and relay RLY2 and this causes the motor to raise the garage door.

In both cases, the motor will continue to rotate until IC3b sees another input either from a limit switch, the local button or the receiver. When this happens the motor will stop. The next input will cause the motor to run in the opposite direction.

Limit switching

So far we've given a general description of the circuit but to understand how the door is stopped when it reaches the top or bottom of its travel, we need to look at the circuit in a little more detail. Note that there are two flipflops in the circuit and these really control all functions. IC1a is the RUN flipflop and it determines whether the motor runs or not. IC1b is the UP/DOWN flipflop and it determines whether the door moves up or down.

When power is first applied, the RC time-constant components at the input of OR gate IC3c apply a reset pulse to pin 4 of IC1a and a set (S) pulse to pin 9 of IC1b, via OR gate IC3a. This causes pin 1 of IC1a to go low (the door STOP) condition and pin 15 of IC1b to go high. This is the UP condition but the motor does not run because both inputs of IC2b must be high for this to occur.

When the keyring transmitter button or the LOCAL switch is first operated, IC1a will change state and its pin 1 will go high but IC1b will not, so the motor will raise the door. The door will continue moving until it comes to the top of its travel whereupon the limit switch will close and take pins 1 & 2 of IC2a high. This takes pin 3 of IC3b high via diode D3 and causes a clock pulse to be delivered to IC1a and IC1b. Both flipflops change state so that IC1a reverts to the STOP condition while IC1a changes to the DOWN condition.

The next time the LOCAL switch or transmitter button is operated, IC1a changes to the RUN condition and the

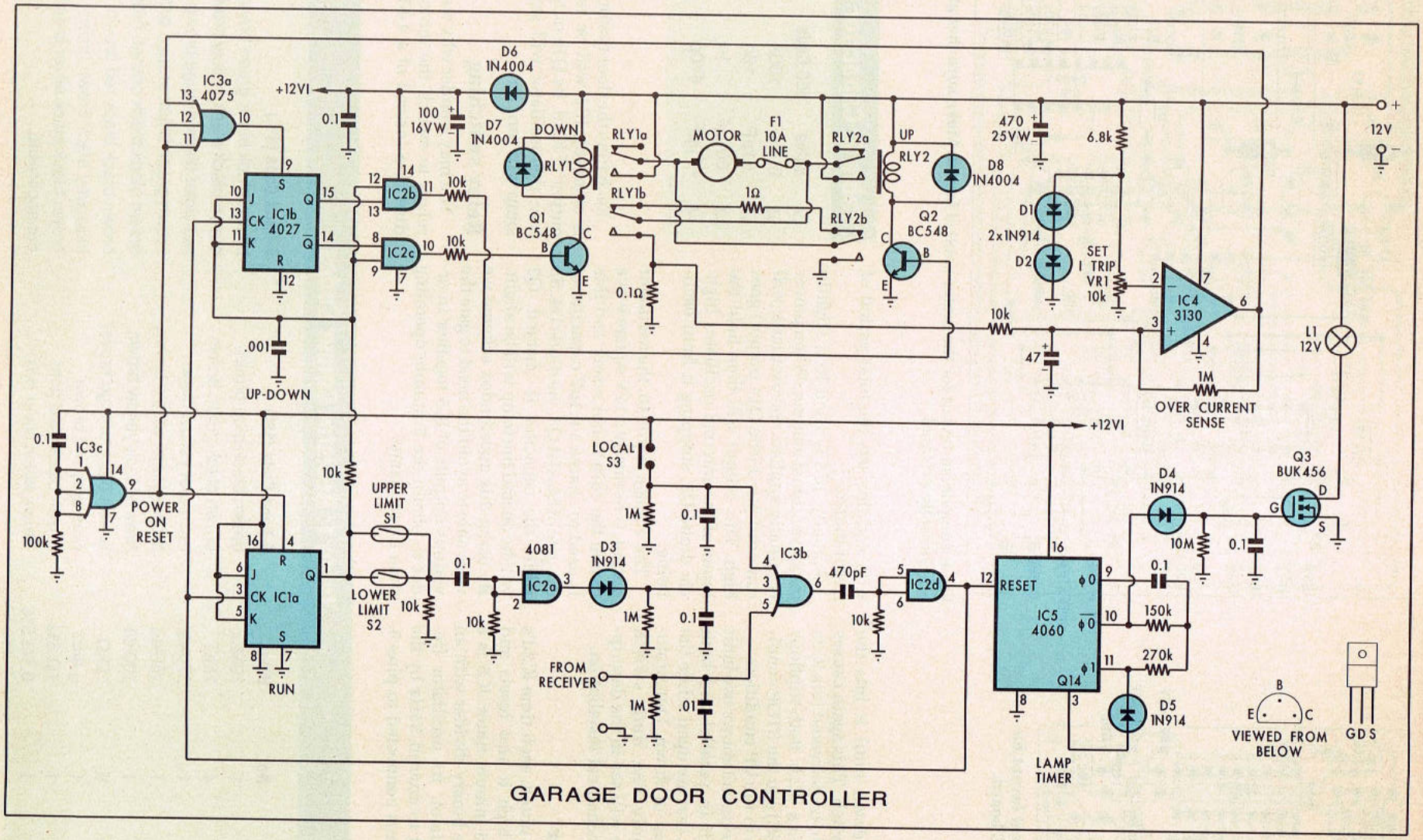


Fig.2: the motor control board uses a dual flipflop and two relays to control the direction of the motor drive. A 1Ω resistor is switched across the motor to provide braking when both relays are de-energised.

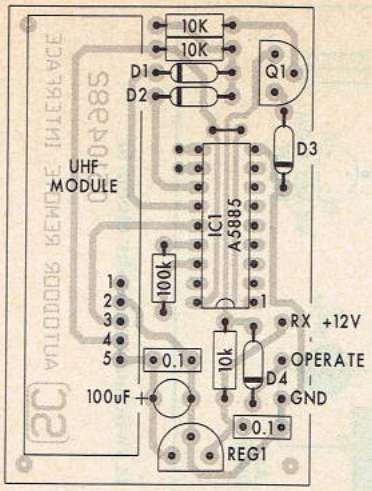


Fig.3: component layout for the receiver PC board.

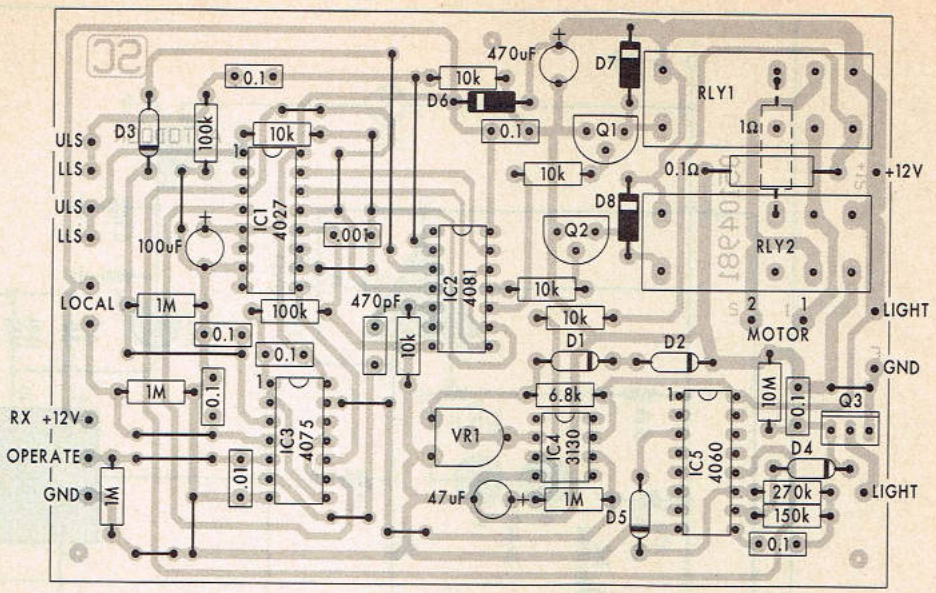


Fig.4: component layout for the motor control board. Make sure that all parts are correctly oriented.

door travels down until it hits the lower limit switch. This again causes a clock pulse to be delivered (via IC2a & IC2d) to IC1a & IC1b. Both flipflops change state, IC1a to the STOP condition and IC1b to the UP condition.

Note that the circuit shows two limit switches, both in parallel and both with contacts that are open while the door travels up or down. Our prototype used only one limit switch though, as we will see in the description of the mechanical installation.

Lamp timer

As already noted, each time IC2d's output goes high it also resets and starts IC5, a 5-minute timer. IC5 is a 4060 14-stage binary divider with an inbuilt oscillator. Its oscillator frequency is set to around 55Hz by the RC components connected to pins 9. & 11 and this sets the total period of five minutes.

Actually, IC5 is used in a slightly unconventional manner. When power is initially applied, the oscillator will run until pin 3 (the Q14 output) goes high. This output will then hold the input of the internal oscillator high, via diode D5, stopping it from oscillating.

The voltage at pin 10, the oscillator output, is normally a 12V square wave (when the chip is not reset), and this is used to charge a 0.1µF capacitor at the gate of Mosfet Q3, via diode D4. So while the capacitor is charged, Q3 will be on and the lamp will be alight. By using this unorthodox scheme we were able to avoid the need to gate the various outputs of IC5 together in order to obtain the 5-minute operating time for the lamp.

Table 2: Capacitor Codes

Value	IEC Code	EIA Code
0.1µF	100n	104
.01µF	10n	103
.001µF	1n	102
470pF	470p	471

Each time the door motor runs (IC1a is clocked), IC5 will be reset by the output of IC2d, its Q14 output will go low, the oscillator will start and the lamp will turn on.

Relay switching

You may wonder why we have used relays to switch the motor in either direction instead of a 4-Mosfet or 4-

Table 1: Resistor Colour Codes

No.	Value	4-Band Code (1%)	5-Band Code (1%)
1	10MΩ	brown black blue brown	brown black black green brown
4	1MΩ	brown black green brown	brown black black yellow brown
1	270kΩ	red violet yellow brown	red violet black orange brown
1	150kΩ	brown green yellow brown	brown green black orange brown
1	100kΩ	brown black yellow brown	brown black black orange brown
6	10kΩ	brown black orange brown	brown black black red brown
1	6.8kΩ	blue grey red brown	blue grey black brown brown
1	1Ω 5%	brown black gold gold	brown black black silver brown
1	0.1Ω 5%	brown black silver gold	not applicable

transistor H-bridge arrangement. The main reasons are the lack of suitable P-channel Mosfets (if Mosfets were used) and the power dissipation if Darlington power transistors were used. By using relays, we were able to keep the switching circuit quite simple.

One further refinement that is possible by using relays instead of a H-bridge is the possibility of motor braking. This is provided by a 1Ω resistor which is switched across the motor when both relays are in the unenergised condition. This means that the motor stops abruptly when power is removed.

If the door encounters an obstruction when it is closing, it will stop and then go back up. This is to prevent injury to people (you or your loved ones) or to your motor car. To achieve this, the motor current is monitored with a 0.1Ω resistor and the resulting voltage is fed to the non-inverting input (pin 3) of op amp IC4 where it is compared with a preset voltage from trimpot VR1 at the inverting input (pin 2). By the way, IC4 is connected to operate as a comparator.

If the voltage across the sensing resistor exceeds that set by VR1, the output of IC4 will go high. This high signal is fed to IC3a, a 3-input OR gate and it "sets" flipflop IC1b so that its Q output goes high and Q-bar goes low. This turns off Q1 and turns on Q2, reversing the direction of the motor.

Because the door operates quite slowly and then reverses if it encounters an obstruction there is little chance of injury to persons or damage to car bonnets etc. It goes without saying that the bottom of the door should be fitted with a rubber weather strip.

In practice, trimpot VR1 is set so that the door closes normally but when it is restrained by slowing it with your hand, the motor reverses.

On the other hand, if the door encounters an obstruction or jams when it is rising or if the current limit circuit fails to work (perish the thought), the resulting high current through the motor will blow the 10A fuse.

Power for the whole circuit comes from a 12V car or sealed lead acid (SLA) battery which will need to be able to deliver around 5-6A each time the door is operated. At other times the current is very low, at just a few milliamps.

The battery should be kept on permanent trickle charge, at around 50-100 milliamps. This current can be supplied by a 12V DC 300mA or 500mA plugpack. These typically deliver about 14-15V at no load and so could be connected permanently across the battery with no limiting resistor.

If the battery voltage tends to rise above 14V under this permanent trickle charge, you will need to connect a limiting resistor in series with the battery. This may need to be found by trial and error and will probably require a 1W resistor with a value in the range from 22-47Ω.

Parts List - Electrical

Main PC board

1 PC board, code 05104981, 112 x 76mm
2 DPDT or DPST relays, DSE P-8012 or equivalent
1 plastic case, 183 x 115 x 64mm, DSE H-2882 or equivalent
1 clear 12V reversing lamp with housing
1 3AG in-line fuse
1 10A 3AG fuse
1 8-way insulated terminal block
2 M3 16mm roundhead screws
10 M3 6mm countersunk screws
2 M3 nuts
2 M3 spring washers
5 M3 10mm tapped spacers
15 PC stakes
1 10kΩ PC-mount preset potentiometer (VR1)

Semiconductors

1 4027 dual flipflop (IC1)
1 4081 quad 2-input AND gate (IC2)
1 4075 triple 3-input OR gate (IC3)
1 CA3130E or CA3160E operational amplifier (IC4)
1 4060 14-stage divider and oscillator (IC5)
2 BC548 NPN transistors (Q1,Q2)
1 BUK456/A/B/H Mosfet (Q3)
5 1N914 diodes (D1-D5)
3 1N4004 diodes (D6-D8)

Capacitors

1 470µF 25VW PC electrolytic
1 100µF 16VW PC electrolytic
1 47µF 16VW PC electrolytic
7 0.1µF MKT polyester
1 .01µF MKT polyester
1 .001µF MKT polyester
1 470pF MKT polyester

Resistors (0.25W, 1%)

1 10MΩ
4 1MΩ
1 270kΩ
1 150kΩ
1 100kΩ
6 10kΩ
1 6.8kΩ
1 1Ω 2W or 5W
1 0.1Ω 2W

Receiver PC board

1 2-channel keyring transmitter (Oatley Electronics)
1 UHF receiver module (Oatley Electronics)
1 PC board, code 05104982, 65 x 41mm
1 A5885M decoder (IC1) (Oatley Electronics)
1 BC548 NPN transistor (Q1)
1 78L05 voltage regulator (REG1)
4 1N914 silicon diodes
1 100µF 16VW PC electrolytic capacitor
2 0.1µF monolithic ceramic capacitors
1 100kΩ resistor
3 10kΩ resistors
1 18-pin IC socket
3 PC stakes

Miscellaneous

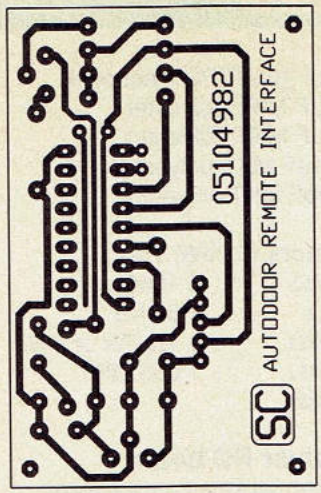
Solder, 24G tinned copper wire, hookup wire, heavy and light duty figure-8 flex.

Electronics construction

We mounted both the receiver and motor electronics PC boards in a plastic utility case measuring 183 x 115 x 64mm. This has the courtesy lamp mounted on its lid and an 8-way strip of insulated terminal block mounted at one end to terminate the various wires from the battery, limit switches, motor and LOCAL switch (S3).

Both PC boards are quite straightforward to assemble. Fig.3 shows the component layout for the receiver board while Fig.4 shows the motor electronics PC board.

Begin by checking both PC boards for shorted or open circuit tracks. You can check the boards against the artworks of Figs.5 & 6. Make any repairs before starting assembly. This done, insert and solder the resistors



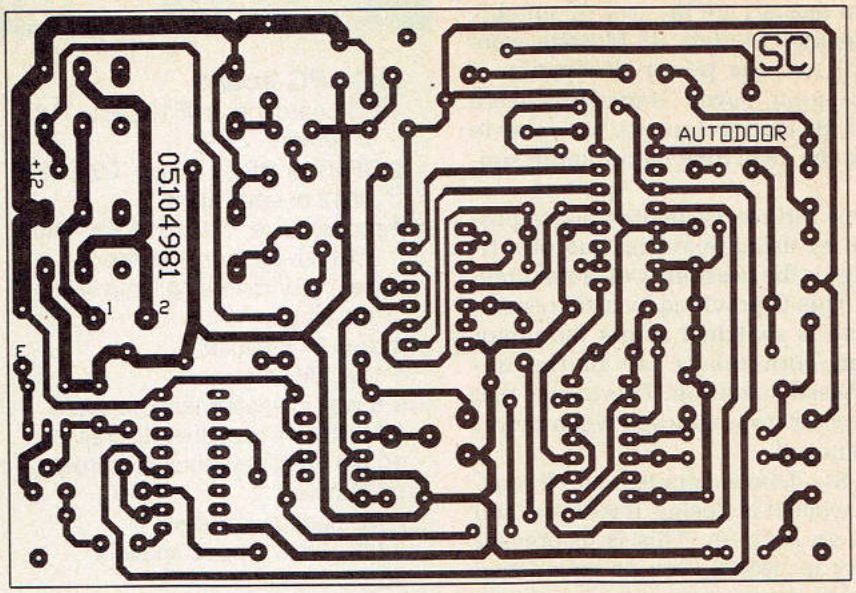
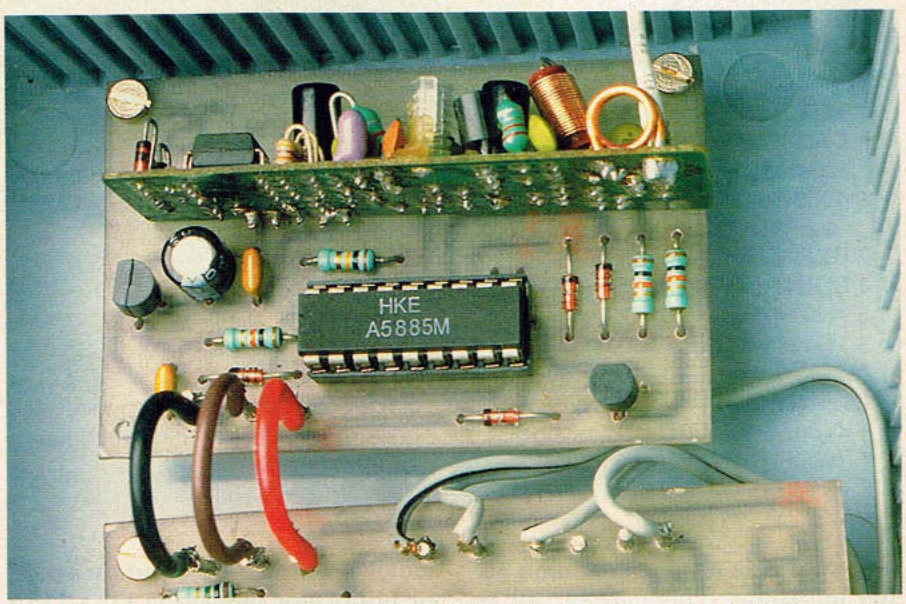


Fig.5: the full-size artworks for the receiver PC board (above) and the motor control board (right).



This close-up view shows the receiver PC board with the pre-built UHF receiver module. It is connected to the controller board using just three links.

and diodes on the receiver board (Fig.3). Next do the IC socket, capacitors, regulator and transistor.

Lastly, fit and solder the PC pins and the UHF receiver module. This has five pins which solder into the PC board. Plug in the IC, checking that pin 1 faces the regulator. Also check the polarity of the electrolytic capacitor.

The same sequence of component assembly applies to the larger PC board, only this time fit the 16 links before starting on the resistors. Use IC sockets if you wish, but if you solder the ICs in place, double-check that pin 1 is correctly orientated on each one. Also double-check the polarity of the electrolytic capacitors.

The last item to be fitted is the 1Ω 2W or 5W resistor on the copper side of the PC board. This is the resistor which provides motor braking when the power is removed.

Testing

The initial tests can be done without the motor or any other external connections. Using a 12V car battery or a DC power supply set to 12V, apply power to the main board. The +12V goes to a PC pin adjacent to the two relays while the 0V goes to the GND pin adjacent to Mosfet Q3.

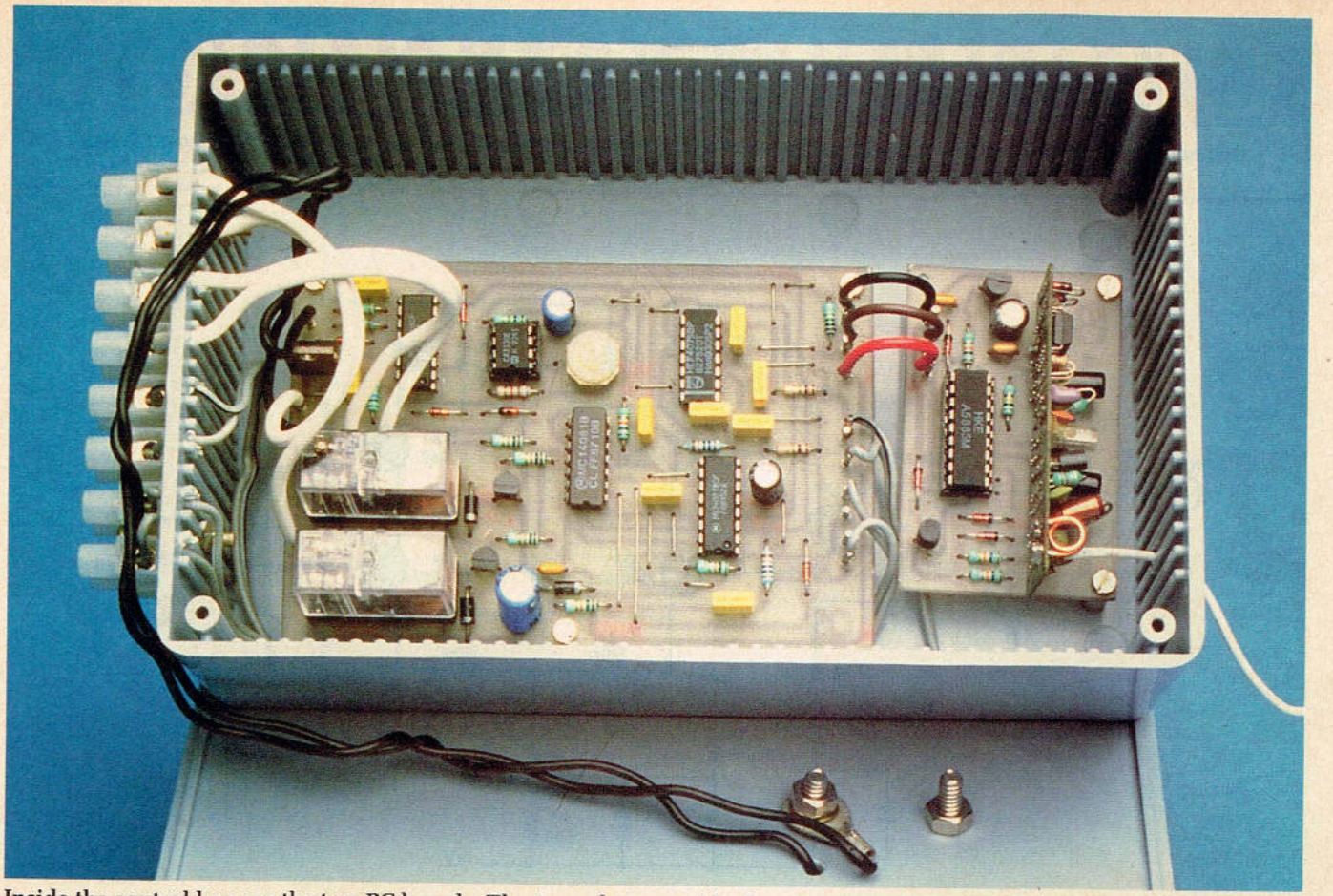
Momentarily bridge the LOCAL PC pins with a piece of wire and relay RLY2 (UP) should energise with an audible click. Bridge them again and the relay should release. Bridging a third time should energise RLY1 (DOWN). Now bridge the limit switch PC pins and the relay should release.

If you wish to test the timer operation, connect the lamp between the PC pins marked LIGHT+ and LIGHT-. Each time the LOCAL pins are bridged, the globe should light for about five minutes.

Remote operation & encoding

Turn the power supply off and solder wires between the three PC pins on the controller PC board and the corresponding pins on the receiver PC board. Reapply the power, press either button on the keyring transmitter and you should hear a relay energise. A second press should release it.

Both the UHF transmitter and UHF receiver boards are supplied unencoded. This allows simple initial testing but once everything is working, both boards should be programmed with the same code. Pins 1-8 and 10 and 11 on the encoder and decoder ICs are used for this. Both PC



Inside the control box are the two PC boards. The two relays provide the motor switching, while the lamp on the control box lid provides illumination in the garage after you have turned your car's headlights off.

boards have a track either side of pins 1-8 and each pin can be left floating, connected to the positive supply or connected to ground.

Pins 10 and 11 will need jumpers to a supply if you use them. The most important step is to make sure that the corresponding pin on **both** the Transmitter and Receiver IC are connected to a similar potential. For your own security you **must not** leave them unencoded.

If you do leave them unencoded, anybody with a similar unencoded transmitter would be able to operate your garage door and thereby gain entry to your home.

Final assembly

You will need to drill the lid of the plastic case to suit the lamp and two insulated wires 300mm long will need to be run to the PC stakes for the light. Having these leads long allows you to finish the wiring without the lid getting in the way.

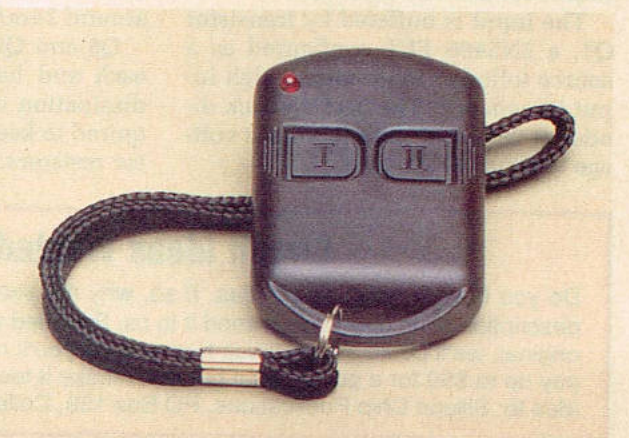
Each PC board was mounted on 10mm threaded pillars. This was mainly to provide clearance for the 1Ω braking resistor on the back of the control board. All the external connections from the PC board were run to an 8-way strip of insulated terminal block at one end of the case. With the plastic case mounted on the wall near the motor and battery, the terminal block is at the top end of the case.

We used heavy duty figure-8 flex for the battery and motor connections and a lighter flex for the limit switch and remote connections.

A small hole was drilled in the bottom end of the case to let the UHF antenna dangle through.

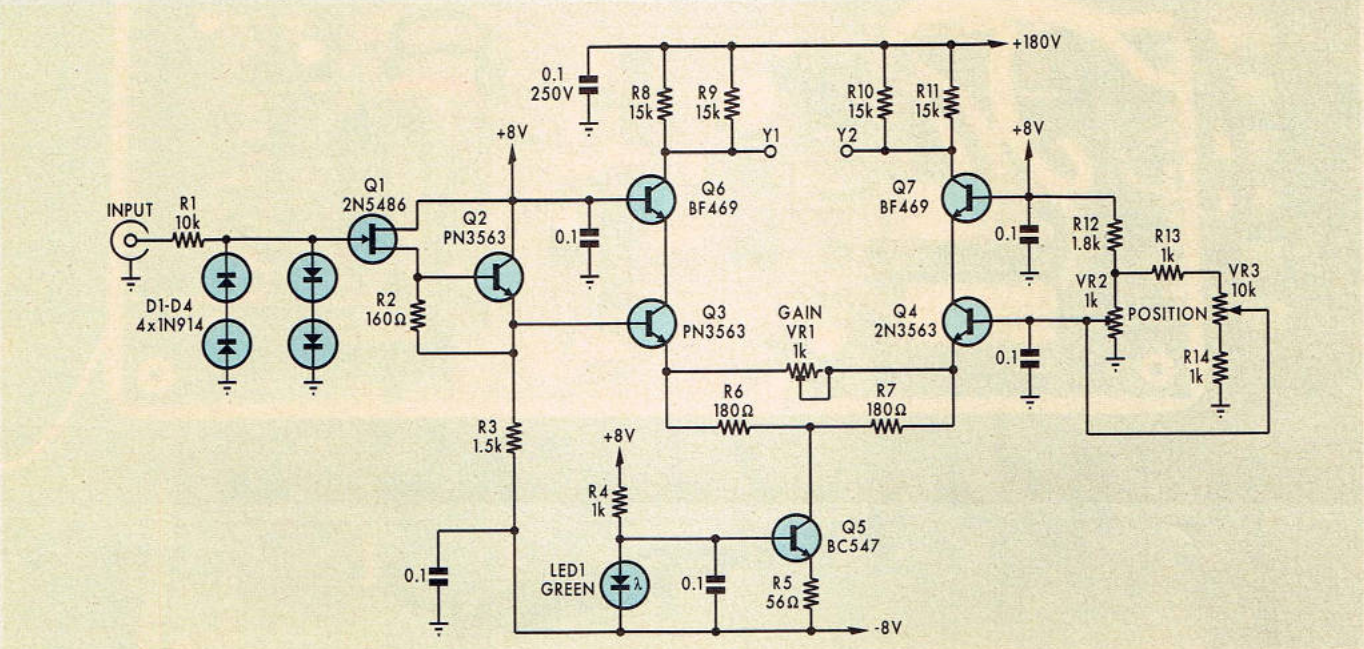
Next month we will provide all the details of the motor/chain drive system, including drawings and photos. With the information provided, you will be able to build your own garage door opener. There is also the possibility of adapting the drive system to raise and lower canvas awnings or to drive sliding doors or gates. **SC**

A standard 2-button keyring transmitter provides full remote control of the garage door opener. It's great in wet and windy weather and in fine weather too.



CIRCUIT NOTEBOOK

Interesting circuit ideas which we have checked but not built and tested. Contributions from readers are welcome and will be paid for at standard rates.



DC amplifier for CRT deflection

This circuit was developed to drive a surplus 60 x 80mm CRT in an oscilloscope. The first part of this project was to develop some amplifiers capable of producing up to 45V output swings, centred at about 100V over a wide frequency range.

The circuit is essentially a differential amplifier with the cascoded output stages and a constant current source for the common 'tail'.

The input is buffered by transistor Q1, a 2N5486 FET configured as a source follower to provide a high input impedance. The back-to-back diodes at the input limit the input voltage to about ±1.2V peak.

Q1 feeds an emitter follower, Q2. Q3, Q4, Q6 & Q7 form a cascode differential amplifier. Q6 & Q6 are specified as BF469, currently the only high voltage, high speed transistor readily available. They provide the high voltage handling capability and hold the collectors of Q3 and Q4 steady at +7.4V, eliminating Miller Effect and ensuring a wide bandwidth.

LED1 acts as a voltage reference of about 2V and in conjunction with NPN transistor Q5, which is wired as a current sink, sets the 'tail' current at around 24mA.

Q6 and Q7 therefore run at 12mA each and have a fairly high power dissipation of 1W. Heatsinks are required to keep them cool. The collector resistors, R8-R11, are 1W carbon types, mounted so that air can freely circulate around them. Do not use 5W wirewound resistors here because their inductance will greatly reduce the bandwidth.

The signal from the input buffer is fed into the base of Q3 – one input of the differential pair. A steady DC voltage is applied to the base of Q4 to give a DC offset or position control. The 1kΩ trimpot (VR2) sets the coarse adjustment of the centre position and the 10kΩ front panel pot (VR3), the fine adjustment.

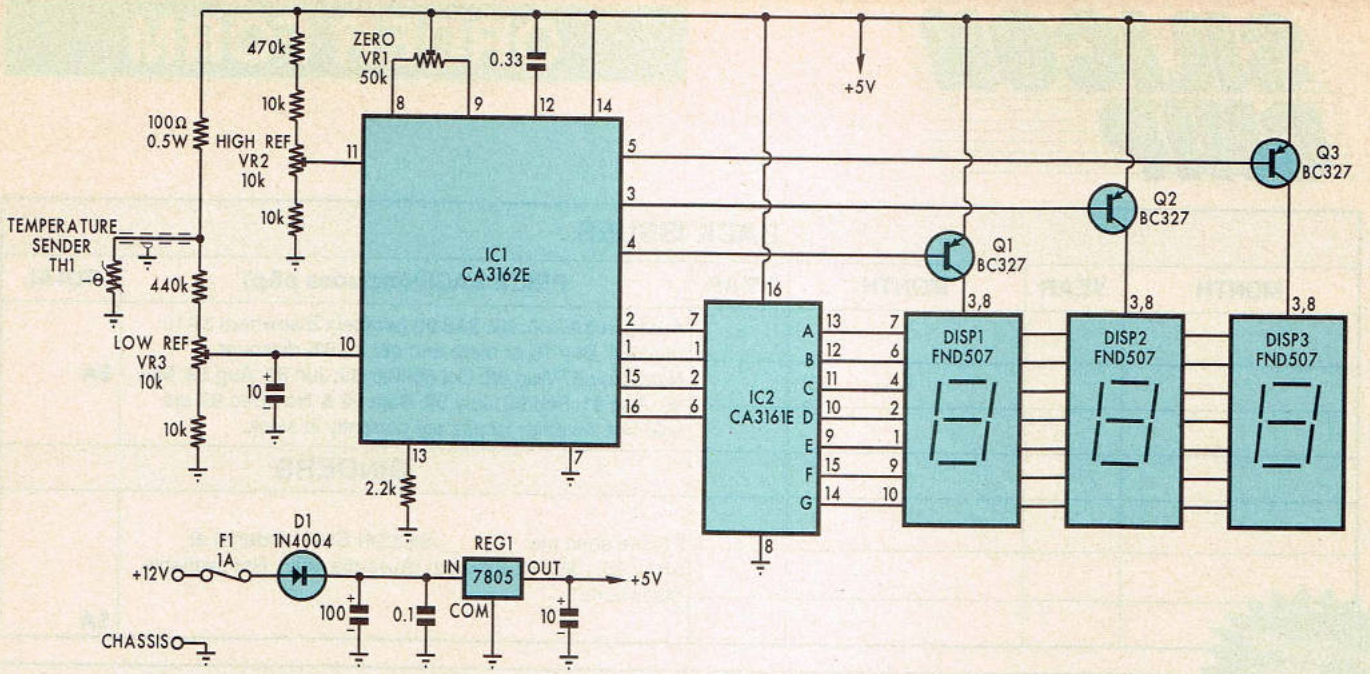
The 1kΩ pot (VR1) between the emitters of Q3 and Q4 changes the effective value of R6 and hence the gain. As shown, the amplifier has a gain adjustable from about 20 to 150.

This amplifier was designed for a CRT with a vertical sensitivity of 3.6V/cm and 5.7V/cm horizontal. The collector resistors were changed to 27kΩ 1W and R5 changed to 100Ω for the horizontal deflection amplifier. This gave a higher gain to compensate for the reduced sensitivity.

N. Baroni,
Ferndale, WA. ($40)

Circuit Ideas Wanted

Do you have a good circuit idea. If so, why not sketch it out, write a brief description of its operation & send it to us. Provided your idea is workable & original, we'll publish it in Circuit Notebook & you'll make some money. We pay up to $60 for a good circuit but don't make it too big please. Send your idea to: Silicon Chip Publications, PO Box 139, Collaroy, 2097.



Engine water temperature gauge

The heart of this circuit is a dual-slope A/D converter, type CA3162E. In this circuit, the differential inputs of this chip are used and the resultant voltage is converted to a BCD output to drive a BCD to 7-segment decoder/driver IC, the CA3161E. This IC has internal current limiting so resistors to the displays are not required.

The temperature sender in most cars has a negative resistance coefficient; ie, as the temperature rises, the resistance falls. When the sensor is cold its resistance will be high and the voltage at pin 10 of the A/D converter will be close to that at the High Ref input, pin 11. The reading on the display will therefore be low. As the temperature of the sensor rises, its resistance falls, thus causing the voltage at pin 10 of IC1 to fall and the reading on the display to rise.

Connection to the sensor should be made with screened cable, earthed at both ends to minimise induced noise.

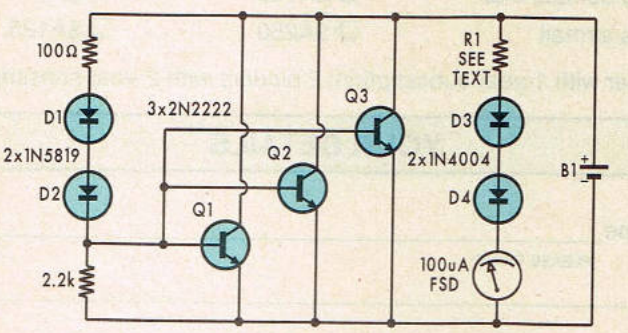
S. Williamson,
Hamilton, NZ. ($40)

Nicad cell tester & discharger

This discharger was designed to load a fully charged cell with about 140mA but reduce to less than 2mA at a cell voltage of just under 1V. It also does not require an external supply.

The circuit was initially tested with one transistor and with a full cell (1.245V) and drew a current of 50mA. Several transistors were then tested in the circuit and two additional transistors having approximately the same consumption were selected, so the unit ended up with three transistors in parallel.

The 100µA meter was used as a voltmeter with a "suppressed zero". At 100µA, the two diodes (D3,D4) each have a forward voltage drop of about 450mV and so the meter reading at zero deflection can be expected to be about 600mV. Full scale deflection will depend on the series resistor R1. Assuming a "burden voltage" for the meter of 200mV, a value of 1.5kΩ for R1 will give a full scale deflection voltage of close to 1.25V.



The prototype instrument gave the discharge currents shown in Table 1 at an ambient temperature of 20°C

It can be assumed that the average discharge current is around 100mA if a full cell is left until its end point of 1.1V. The 1N5819 Schottky diodes are available from Dick Smith Electronics at 40 cents each (Cat Z-32500).

TABLE 1

Battery Voltage	Current
1.247V	130mA
1.116V	80mA
1.0V	20mA
0.914V	2mA
0.86V	0.4mA

V. Erdstein,
Highett, Vic. ($35)

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Jaycar ELECTRONICS

APRIL SALE

Prices valid until April 30th.

All prices in Australian Dollars - New Zealand customers please ask for New Zealand prices.

Audio Video UHF Transmitter

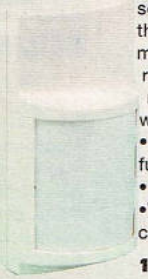
NEW in 98

Watch videos on a second television without running cables from one room to another. This video sender plugs into your VCR and will transmit a quality AV signal to any UHF TV within 5-10 metres. Features solid metal case with non slip rubber feet, telescopic antenna, power indicator, gold RCA sockets, adjustable input gain and channel fine tuning. Specifications: •Range, 5-10 metres •Transmitter, UHF channel 30 •Input, composite video and audio line level input •12VAC 300mA input •Size, 123(L) x 85(W) x 40(H)mm. Supplied with VCR/RCA leads, AC mains adaptor. Don't pay $89.95 elsewhere.

Cat. AV-6505 **$79.95**

Duotector Burglar Alarm PIR/Microwave Detector

NEW in 98



We sold these high Quality Japanese detectors in 1996 for $99.95 and have secured a limited quantity of 10 and 15 metre-range units for a fraction of their 1996 sale price. For the unit to trigger an alarm, both the PIR and microwave detectors must be triggered at the same time - substantially reducing the chance of false triggering. Two models are available, a 10 metre range for domestic security and a 15 metre range for warehouse and halls where a long narrow beam is required. Features: •Mic doppler module •Dual element PIR sensor •Latching memory function •Walk test LED •LED monitor for both microwave and PIR •RFI protection •Tamper protection •Microwave supervised output •Wall/corner mountable design •Low current 18mA at 12VDC •Auto temp. compensation •Size 61(W) x 120(H) x 50(D)mm. Supplied with mounting screws.

MADE IN JAPAN

10 METRE LONG RANGE Cat. LA-5012 **$69.50**

15 METRE LONG RANGE Cat. LA-5013 PRICE BREAKTHROUGH **$79.50**

MULTI SYMBOL KEYRING LASER POINTER

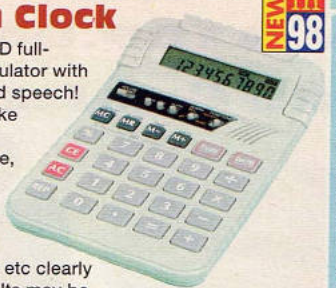
This fantastic new laser pointer comes with 6 different screw-in end caps, each one being a fun symbol - skull, victory sign (2 fingers), an arrow, cupid, a woman and I love U.Remove the end cap, and it can be used as a normal laser pointer. It has a clear, see through case, where you can see the inner workings. There are also 2 red & 2 green high brightness mini LEDs that flash quickly.

NEW in 98

Cat. ST-3104 **$49.95**

Talking Calculator / Alarm Clock

NEW in 98



A 10-digit LCD full-featured calculator with clear digitised speech! Each keystroke triggers the digitised voice, with all calculations such as addition, multiplication etc clearly spoken. Results may be repeated with the touch of a button, as many times as you wish. Features: •Time •Data •Alarm (with either standard or musical notification) •Adjustable volume (which can also be turned off) •15 alarm songs switching between spoken units or individual digits (i.e. "eight-seven-five" or "eight hundred and seventy five"). This unique calculator includes soft rubber buttons and requires 2 x AAA batteries - not included, use our SB-2426.

Cat. QM-7276 **$29.95**

New Telephone Double Adaptors

NEW in 98

Virtually all new telephone equipment uses US-style RJ12 connectors. These adaptors acknowledge that fact by offering standard Aussie plugs to RJ12 sockets. Suitable for fax, modem, cordless phones, caller I.D. etc. 2 new models available.

AUSTRALIAN PLUG TO 1 X AUSTRALIAN SOCKET & 1 X US SOCKET

Cat. YT-6024 **$7.95**

AUSTRALIAN PLUG TO 2 X US SOCKETS

Cat. YT-6022 **$7.95**

Fixed Gearbox With Motor

NEW in 98

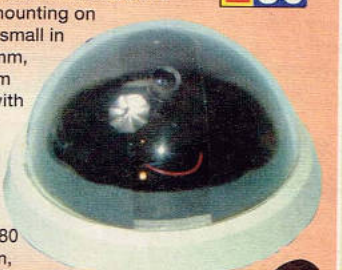
Now for 1998. Inexpensive replacement motor for toys or experimenters / designers.

Specifications: •1.5V to 3VDC •6650 rpm •6.4g / cm torque •Gearbox ratio, 233:1 •2.5mm drive shaft diam. 100mm length •Features metal gearbox housing and motor flyleads.

Cat. YG-2725 **$6.95**

CCD Dome Camera

NEW in 98



The black and white CCD camera is mounted in a black dome, and is ideal for mounting on a ceiling or wall. The dome is small in size, having a diameter of 87mm, and the dome protrudes 55mm out from the base. Supplied with short lead (160mm) with BNC socket for video signal and DC socket for power (12V). Specifications: •Pick up element, 1/3" CCD •Pixel, 510(H) x 492(V) •Resolution, 380 TV lines •Minimum illumination, 0.5lux / F2.0 •S/N ratio, more than 46dB •Electronic shutter, 1/60(1/50) to 1/100,000 auto •Power, 12V DC +/-10% •Current consumption, 110mA •Size, 87mmdiameter x 55mm deep •Weight, 100g.

Cat. QC-3472 **$139**

100 Watt 240VAC to 115VAC Stepdown Transformer*

Includes overheat protection! If the unit gets too hot, the thermal fuse will open, then close after unit cools down, restoring operation. Two pin US socket on unit for 110V appliance and cord plug for 240V power. Amazing low price. •100V.A

Cat. MF-1091 **$49.95**

NEW CATALOGUE

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UNIVERSAL IN-DOOR POWER WINDOW KIT

The Jaycar LR-8840 Universal Power Window Kit is designed to fit INSIDE the door. The key to the system is the REALLY NIFTY in-the-door motor drive / transmission system. The drive head has a kit of adaptors so that it will mate with virtually any make of winder mechanism. You also get a kit of "blanks" to cover where the winder hole is (was!), in your door trim. In addition to this you get the complete wiring wiring harness fully made up! You also get a swag of other brackets, springs, clips, screws and other hardware to make your job easier. The downside to all of this is that the instructions are fairly crude. They are quite pictorial but we cannot say that they are great, You WILL need to be fairly mechanically skilled and motivated to do the job. Aftermarket fast glass costs between $800 - $1,000 installed so you will save a bundle by doing it yourself.

2 DOOR VERSION Cat. LR-8840 **$249.00**

CCD PCB CAMERA WITH INFRA-RED ILLUMINATION

This camera includes six IR LEDs mounted on the PCB for 24 hour monitoring. ie. It can "see" in the dark. Despite the use of IR LEDs, the incredibly compact nature of the camera has been maintained at just 32 x 38mm For audio, use Cat QC-3468 add on audio board $19.95.

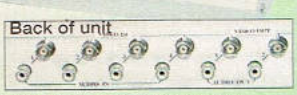
Cat. QC-3465 **$135.00**

CEILING ALARM WITH REMOTE CONTROL

This stand alone alarm utilises a passive infrared detector with a 360° lens, and an ultra loud 130dB piezo alarm to provide no-hassles home, apartment, office, garage, boat or caravan protection. Spare remote controls available Cat LA-5153 $14.95ea

Cat. LA-5152 **$54.95**

CCD 4 WAY CAMERA SWITCHER



This automatic switchbox accepts up to four video inputs from CCD/CMOS cameras on up to two video monitors. For example, you can scan cameras "1" and "2" and display on video monitor number one, and scan cameras "3" and "4", with their outputs displayed on the second video monitor. This is just an example and in fact any combination of the four cameras can be scanned and displayed on either monitor. Audio channels are provided for each of the separate inputs and outputs. This product is straight-forward to use, with on screen instructions to set up camera switching, inter-camera scan time duration and time/date information. Mains adaptor incl.

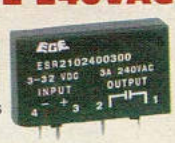
Cat. QC-3480 **$229.50**

1,000,000µF (1 FARAD) 20V DC CAR AUDIO REINFORCING CAPACITOR

One(1) farad caps serve to bolster the power supply of your car's audio amplifiers by acting as a reservoir. They also lower supply line impedance and remove most DC ripple. Also includes mounting bracket.

Cat. RU-6750 **$199.00**

3-32VDC SOLID STATE 240VAC @ 3A RELAY



This is a PCB mounting, single in line package relay capable of switching up to 240V AC at 3 amps. Use this relay in conjunction with our new remote control switches for safe 240V AC mains switching. Specs: Input Circuit •Control Voltage Range: 3-32V DC •Min. turn off voltage: 1V DC •Control Current: 15mA Max •Input Resistance: 2.2kΩ min Output Circuit •Max load current: 3A RMS •Nominal Line Voltage: 240V AC •Load Voltage Range: 24-280V AC •Min. Blocking Voltage: 600V AC •Max one-cycle surge current: 80A RMS • Dimensions:10(D) x 42(W) x 25(H)mm

Cat. SY-4080 **$19.95**

Jaytech 8 Sector Alarm Deal

Save a fortune by buying our ALARM DEAL using the Jaytech 6000 panel. Includes all the components needed to give you a quality basic home alarm system. All you need is a bit of labour and you have a reliable affordable alarm that offers you peace of mind.

SAVE $75

Pay Only $219

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1 x mains power supply	$21.50
2 x reed/magnet switches	$11.90
1 x siren horn	$23.95
2 x deterrent stickers	$4.00
60 m of 4 core alarm cable	$51.00
NORMALLY PAY	$285.75

Cat. LA-5450

EMAIL ORDERS mailorders@jaycar.com.au

POWER PACKS

12V DC 1AMP REGULATED

Brand new unit for 1998. Delivers 12V DC at any current draw up to 1 amp. Ideal for sensitive equipment that requires spot on voltage. Supplied with 7 plugs. Desktop type unit.

Cat. MP-3033 **$32.95**

24V DC 1AMP REGULATED

Brand new unit for 1998. Regulated power supply means that it will deliver 24V at any current drawn up to 1 amp. This power supply is in a desktop style case with 1.8 metre long 240V power lead and 1.8 metre output lead to 7 plug adaptors .

Cat. MP-3037 **$42.95**

All our power supplies are fully approved

Hakko 936 Soldering Station

Features of the 936 include: •Thinner grip for easier use. •Solder dripping from the tip falls into the stand instead of onto the work bench. •Lock screw prevents inadvertent changes in the temperature setting. •Compact size and can be stackable so 2 units takes up the space of one unit. •C° and F° temp scales. •50W 24V. •200 - 480°C. •Temp stability +/-0.5°.

Cat TS-1610 **$199**

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EQUATOR

"FULL FEATURE" 260 CAR ALARM

NEW MODEL

NEW in 98

Brand new 1998 model Equator car alarm with ALL the very latest technology. This car alarm has everything that you could possibly ask for. See the list of features following! The Equator 260 is supplied with 2 brand new black keyfobs with slightly recessed (but easy to use) switches. The alarm is supplied 2 ways, with either the new mini sized standard siren, or the mini sized backup battery siren. The new small sirens make them much easier to mount in smaller cars. Features: **•Active arming. •Anti scanning. •Automatic Rearm. •Carjacking countermeasures. •Chirp Delete. •Code Learning. •Domelight Delay. •Door Lock/Unlock. •Door Security Warning. •Engine Killer. •Hard programming. •Instant Trigger. •Last Door Arming. •LED Status Indicator. •Light Flash Confirmation. •Non Volatile Memory. •Overide Switch. •Parking Lot Panic/Car Search. •Power interrupt alarm. •Programmable Features. •Random Code Transmission. •Remote Boot Release.•Rolling Theft Protection. •Sensor bypass. •Shock Sensor. •Trigger Memory Indicator. •Valet Mode. •Voidable Code Viability.**

GREAT VALUE

Equator 260 - What you get

• Blackbox electronic module with all the above features • 2 transmitter key fobs • Ignition cut out relay • Shock sensor • Wiring • Mini Size Siren

Cat. LA-8940 **$219.00**

Spare Code Learning Remotes

Cat. LA-8945 **$34.95ea**

Equator 260 Back Up - What you get

• Blackbox electronic module with all the above features • 2 transmitter key fobs • Ignition cut out relay • Shock sensor • Wiring • Mini Size Back up Battery Siren

Cat. LA-8950 **$239.00**

GOLD 2 RCA - 2 RCA BUDGET AUDIO LEADS

NEW in 98

This range of leads feature moulded gold plated RCA plugs on a single shield blue cable with a centre wire for remote amp switching or home Hi-Fi grounding. Fig 8 cable with each lead 3.5mm OD.

Cat. WA-1055	1.5 metres	$7.95
Cat. WA-1056	2.5 metres	$9.95
Cat. WA-1058	5.0 metres	$13.95

PROFESSIONAL OFC DOUBLE SHIELDED RCA LEADS

NEW in 98

The cable is heavy duty, double shielded figure 8, purple in colour with a central lead for remote amp switching or grounding on home Hi-Fi systems. Each lead is 6mm OD with a nice flexible rubber insulation & features a pair of gold plated high quality metal RCA plugs on each end.

Cat. WA-1090	1.5 metres	$24.95
Cat. WA-1092	2.5 metres	$29.95
Cat. WA-1094	5.0 metres	$34.95

2 RCA PLUG TO 1 RCA SOCKET OFC Y-CABLE

NEW in 98

Use this lead to split a line level from your car audio deck to two separate power amps or active crossovers etc. Supplied with moulded gold RCA connectors on a 30cm length of screened audio cable.

Cat. WA-1065 **30 centimetres** **$7.95**

HEAVY DUTY CAR NOISE SUPPRESSOR

This filter is suited to high-end audio systems that draw anywhere from 40 amps to 120 amps. It has an excellent LC network which comprises, 4µH and 0.5µH choke plus 6, yes 6 x 4,700uF filter capacitors - a total of 28,200 uF of filtering! Connections are via three gold terminal sockets to suit 4AG cable.

Cat. AA-3080 **$79.50**

NEW in 98

11 PC CELLULAR PHONE TOOLKIT

NEW in 98

Service your own mobile phone! This kit includes essential tools to access the internals of mobile phones. You get: •Torx T5 and T6 •Tamperproof Torx T8 • Phillips No 3 •Flatblade No 2 plus pin drive (snake), an angled flatblade tool to help pry lid assemblies plus two custom antenna release toolbits and dedicated driver. Quality chrome vanadium presented in a felt lined carry case.

Cat. TD-2024 **$24.95**

6 PIECE PRECISION TAMPERPROOF TORX SET

NEW in 98

A quality set of chrome vanadium drivers consisting of T7, T8, T9, T10, T15 and T20. All drivers are 145mm length & presented in a felt-lined plastic case.

Cat. TD-2021 **$14.95**

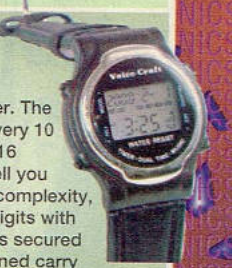
METAL MAGNETIC DISH

NEW in 98

This clever product will retain all manner of hardware. The enamel coated metal bowl is magnetised, even if the bowl is tipped over the parts will stay put. Rubber non slip base.

Cereal dish size. Cat.TH-1970 **$9.95**

MULTI-FUNCTION TALKING WATCH



NEW in 98

This watch features dual time zones, alarm and countdown timer. The countdown timer delivers voice reports from every second to every 10 minutes depending on the countdown time duration. There are 16 different alarm 'songs' to choose from. The watch will literally tell you the time with just the press of a button, and despite its relative complexity, is easy to operate. The watch LCD features large easy to read digits with both the time and date displayed at once. The time piece itself is secured to a nice leather wrist band, and is presented in its own velvet lined carry case. Includes battery and instruction manual

Cat. XC-0280 **$24.95**

12V 2A Solar Battery Charger Regulator

NEW in 98

This compact regulator protects the battery against overcharging, discharging at night and deep discharge. Installation is straight forward with just 3 wire pairs: solar panel, battery and load. Two status LED's are included to indicate load and charge states. Specs: •Nom voltage: 12V •Max solar panel voltage: 24V •Max solar panel current: 2A •Overcharge volt limit: 14.2V •Discharge volt limit: 10.8V •Regulator consumption: 5mA

Cat. MP-3120 **$69.95**

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

Light Dimmers

Set the mood in your room by dimming the lights.
3 types available.

With Architrave Plate NEW in 98

Rotary dimmer with on/off switch on small white plate.

Cat. PS-4082 **$16.95**

With Wall Plate NEW in 98

Rotary dimmer with on/off switch on large white plate.

Cat. PS-4084

$16.95

Dimmer Only (Mechanism) NEW in 98

Add it to an existing switchplate.

Cat PS-4080 **$10.95**

Reed Switch Magnet Assemblies

These are used to secure an alarm circuit on a door or window. Sold as a pair, one has a magnet inside, the other a reed switch with self adhesive or screw mount. Screw terminating. Normally open (n.o.) per pair. Cat. LA-5072

$3.95 NEW in 98

PC Ventilator

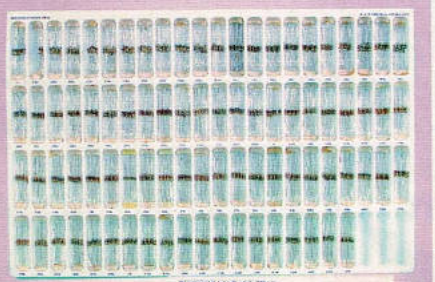
Mounted inside a PC case, the PC Ventilator is a heat extractor with two fully adjustable 40mm fans, each mounted on it's own swivel axis, extendable assemply, & both fans extract heat. To install, you plug the Ventilator into a spare ISA/PCI slot on your motherboard, and point the fans at the desired heat-generating points. The fans then plug in line with your disk drive power lead to extract 12V DC.

NEW in 98

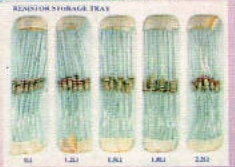
Cat. XC-5045

$39.95

Professional Resistor Storage Tray with Resistors



This resistor storage tray filled up with 10 of every value 1/4W 5% resistor from 1Ω to 10meg. 85 values in all, 850 resistors in total. Each compartment has been screen printed with the resistor value in it. No sorting out required! Includes clear slide-off lid. NEW in 98



Cat. HB-6340 **$37.95**

Lower Prices on Maxell CD-Rs

Green Cat. XC-4711 **$3.95**

Gold Cat. XC-4710 **$4.95**

CCD Camera in Metal Case

NEW in 98

A standard PCB CCD mounted in a metal diecast case, complete with metal mounting bracket, BNC video out lead and DC input power in-line socket. If mounting and setting up one of the PCB-based cameras is too daunting - then this self-contained camera is what you want.Size 39 x 39 x 26mm (45mm with bracket).

Cat. QC-3470 **$145.00**

Sound Feeder Wireless Audio Transmitter

This new model sound feeder accepts any line level input such as a portable CD player, video game, etc and transmits the stereo signal to a FM receiver such as your car radio or home stereo. Specifications: •Voltage: 1.5V (AA Battery) •Tuning Freq: 88-108mHz •Transmission Range : 4-6FT (1.2M - 1.8M) NEW in 98

Cat. AR-1752 **$49.95**

Key Ring Laser Pointer

Cat. ST-3102

Only $39.95

NEW in 98

Remote Control Switches

NEW in 98

Latching Unit:

This unit has both Normally Open and Normally Closed contacts. Ideal for switching on / off a home burglar alarm, house appliances etc. 2 transmitters and 1 receiver supplied. Cat. LR-8820 **$89.95**

Momentary Unit:

This unit has two relays in the receiver. Both relays can be wired in either Normally Open or Normally Closed contacts wiring configurations. Ideal for car central locking, car alarms, switch logic circuits, remote paging using 2 different buzzers etc etc. •2 transmitters and 1 receiver supplied

Cat. LR-8822 **$109.95**

SUBWOOFER DEALS

ADD A SUBWOOFER/AMPLIFIER TO YOUR CAR SOUND SYSTEM

RE/SPONSE

No1 AMPLIFIER 4 x 50 WRMS

Bridge 2 channels together to give about 100W RMS to drive the sub, and that leaves 50 WRMS x 2 to drive your rear speakers.

Cat. AA-0438 **$329**

Subwoofer

10" Polycone Re/Sponse

Cat. CS-2236 **$109**

Subwoofer Cabinet

Supplied in knockdown form.

Cat. CS-2532 **$99**

Total $537 Save $48

Buy together for $489

No 2 AMPLIFIER 2 x 100 WRMS

Bridge 2 channels together to give about 200W RMS to drive the sub.

Cat. AA-0432 **$239**

Subwoofer

10" Polycone Re/Sponse

Cat. CS-2236 **$109**

Subwoofer Cabinet

Supplied in knockdown form.

Cat. CS-2532 **$99**

Total $447 Save $48

Add $56 for Carbon Fibre Woofer Cat. CS-2244

Buy together for $399

JAYCAR WHOLESALE (02) 9743-5222

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

PROGRAMMABLE ENTRY ALARM / CHIME

This unit simply mounts on a door or window. When the door or window is opened the unit either chimes, or the siren goes off. It is switched on/off by a keypad and there is also a panic button for emergencies. Includes 2 warning stickers. Requires 3 x AAA alkaline batteries (not supplied). Uses magnetic sensor switch for contacts. Limited qty. Cat. LA-5160

~~Was $49.50 $24.95 $17.95~~

April $12.95

WINDOW / DOOR MAGNETIC SENSOR ALARM

This small alarm is designed to be mounted on a window or door. When the door / window is opened, a built-in 90dB alarm sounds. Its very compact and has an on/off switch on the body. If a burglar forces a window open and the alarm sounds, there is a very good chance the burglar will leave. If you want to open the window, simply turn it off. Colour-white. Supplied with 2 alarm stickers, double sided adhesive tape and screws. Limited quantity. Cat. LA-5165

~~Was $19.95 $9.95 $7.95~~

April $5.00

VIBRATION DOOR / CHIME / ALARM

This unit simply hangs on the door knob inside a room. When the door is opened or shaken it will "sound". There are 2 sounding settings - chime and alarm. Operates from a 9V battery (not supplied). Includes 2 alarm stickers.

Cat. LA-5170 Limited quantity.

~~Was $19.95 $7.95~~

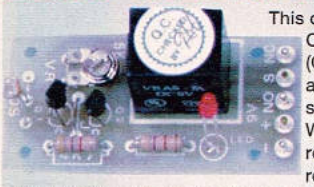
Now $5

12V WIND UP EXTENSION REEL

Winds into its plastic housing for easy storage. The cable length is 4 metres. The reel has two cigarette lighter sockets for powering equipment. Size: 115mm diameter. Current 10A. Ltd. qty. Cat. PP-2016

Was $12.95 April $8.95 Save $4

LIGHT OPERATED SWITCH



This controller uses a Cadmium Sulphide (CdS) cell to detect an ambient light level, the sensitivity is adjustable. When the level of light reaches a certain value the relay (with N.O. or N.C. outputs) switches on, it remains on until the light level falls below a predetermined value. Cat. AA-0344

Was $14.50 April $10.50 Save $4

STEREO CONDENSER MICROPHONE

Stereo microphones are ideal when you are recording into stereo VCR or a stereo tape deck.If one mic is used, only one channel is recorded, its a bit difficult holding 2 mics!! This mic is two channel and has two 6.5mm plugs for output (Clearly marked with L and R.). Its condenser, requires 1 - AA battery. Supplied with mic holder. Ideal for outside use because includes special built in wind screen. •Freq resp: 100Hz - 16kHz •Sensitivity: -68 +/-3dB •Output Imp: 600Ω •Cord: 3 metre with 2 x 6.5mm plugs •Power supply: 1.5V AA battery

Cat. AM-4095 **Was $39.95**

Now $29.95

Save $10

AUSTRALIAN FLAG

Our Australian flag measures 900 x 600mm and is made from polyester. Hang one outside your home, over a window, on a flagpole, anywhere you like.

Cat. BF-8500

Was $9.95 April $5

WALK-BY SAFETY SECURITY LIGHT

NEW in 98

This is a portable light which uses a PIR detector to activate the light from 5 to 30 seconds after movement has been detected. It can be mounted on a wall or placed on any flat surface. Use it in stairwells, childrens room. garage, cupboards, sheds, attics, boats, caravans, etc. The unit can be battery powered using 4 x D cell batteries (not included - use our SB-2343) or use a 6V DC mains adaptor, MP-3016. As the walk by light only works at night, precious battery power is conserved during the day whenever someone walks past the PIR. Light size 210(W) x 110(H) x 220mm(D).

Cat. LA-5140 **$32.95**

REMOTE CONTROL MINI ALARM WITH PIR DETECTOR

NEW in 98

This is a self contained alarm with inbuilt PIR detector and siren. The detector can pick up movement up to 7 metres away, making it perfect for home, apartment, garage, office boat or caravan security. Features include: •ultra loud 130dB siren •arm/disarm remote control with keyring •use four AA alkaline cells (not included,) or an AC adaptor - use our regulated MP-3030 plugpack.

Cat. LA-5142 **$47.95**

SPARE REMOTE CONTROL Cat LA-5143 **$17.95.**

EXTERNAL SIREN Cat LA-5144 **$18.95.**

RARE EARTH NEO "SCARY" MAGNET

NEW in 98

Last year we made a surplus purchase of uncoated ferrite rare earth magnets. They were immensely popular but with a limited quantity only, they sold out within weeks. These new magnets are nickel coated to prevent the magnet from shattering, and are supplied in their own protective iron shielding case for transportation. These magnets are so strong that they're scary - especially when in pairs!! Their incredible power will simply blow you away & challenge your thinking about magnets.

20(d) x 5mm Cat. LM-1618 **$12.95**

32 PIECE RATCHET HANDLE & BIT SET

NEW in 98

This kit includes: •Phillips No.0, No. 1 •Posidrive No. 2, No. 3 • Torx 1.5, 2, 2.5, 3, 4, 5 and 6mm • Flatblade 4, 5, and 6mm •Tamperproof Torx T10, T15, T20, T25, T27 and T30. But wait - that's not all! You also get a great range of sockets: 4.5, 5, 5.5, 6, 7, 8, 10, 12, 13 and 14mm. This kit includes a quality, well made ratchet handle with reverse action lever and a nice non-slip handle. The bits are a collection of gold plated chrome vanadium and chrome vanadium steel and heat treated. Supplied in a neat, plastic carry case. Cat. TD-2043

$19.95

SEALED LEAD ACID BATTERIES

NEW in 98

Lower prices for 1998. New 18AH 12Volt

6 VOLT

4 AMP Cat. SB-2496 **$17.95**

12 AMP Cat. SB-2497 **$29.95**

5 AMP LANTERN BATT. Cat. SB-2498 **$29.95**

12 VOLT

1.3 AMP Cat. SB-2480 **$24.95**

4.2 AMP Cat. SB-2484 **$32.95**

7.0 AMP Cat. SB-2486 **$39.95**

18 AMP Cat. SB-2490 **$79.95**

NEW KIT - VIDEO FADER & WIPER

NEW in 98

Ref EA April 1998. Make your home videos professional!!! Similar to our video enhancer /stabiliser kit, this kit will accomplish manual video fading and wiping in black, grey and white. It also allows background fading with horizontal & vertical wiping, it has as on board enhancer so you won't lose any signal. Kit includes box, silkscreened front panel and all quality electronic components. Power source required 12VDC @ 150mA use MP-3002 $11.50.

Cat. KA-1807 **$69.95**

JAYCAR ELECTRONICS

JAYCAR ELECTRONICS

Dwell Tacho DMM

- RPM x 1, x10
- Dwell angle
- Resistance
- DC volts
- Holster included

Cat. QM-1440

$79.95

11 Digit Fluoro Bargain!!!

Vacuum fluorescent displays - still look the best. Each digit measures 6.0mm(H) x 3.5mm(W), 11 digits in all. The display also features an apostrophe in the top right hand corner of the digits, and a semicolon (;) in the bottom in all 11 digits. Electrical and mechanical data is included in the price. Cat. ZD-1880

NEW in 98

Was $3.95 Save $2 Only $1.95

Driver IC Allegro Brand UDN6118A

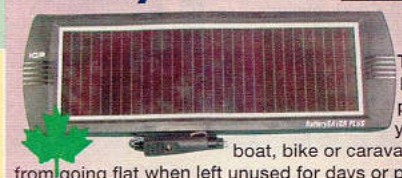
Cat. ZD-1882 **Was $4.95 Save $3.95 Only $1**

network VODAFONE from JAYCAR

Contact our stores for our current super deals on Cellular Phones

1.8W Solar Car Battery Booster

NEW in 98



This solar booster prevents your car, boat, bike or caravan battery from going flat when left unused for days or prolonged periods of time. Easy to install, the panel sits on your dashboard or rear parcel shelf & with direct sunlight, will deliver 15V @ 125mA. This is a quality product made in Canada. Cat. ZM-9050 **$59.00**

5 Watt Solar Car Battery Booster

NEW in 98

This 5 watt panel is suited to permanent installations on boats, caravans or trucks, 4WD farm equipment etc. Frame 325(W)x345(H)x 18mm(D). Cat. ZM-9052

$119.50

Telephone Caller Identification Unit

NEW in 98

AUSTRALIA ONLY

What will it do? A 3 line LCD screen indicates an incoming caller's phone number as well as time and date of call. Other features include: •Last 95 incoming caller numbers recorded in memory •New call and total call summaries indicated •Blocked call, private number, pay phone and mobile call indicators •Call back one-button dialler •Voice mailbox message indicator. The unit will also display the incoming caller's name when Telstra introduces this expanded service. Requires one 9V battery, or use AC plugpack adaptor, MP3007. Beware of similar units available elsewhere that offer only a fraction of the features listed above. Many people overseas now prefer to use call I.D. rather than a telephone answering machine.

Cat. YT-6010 **$59.95**

12V 2 Amp Solar Battery Charger Regulator

NEW in 98

Charging 12V batteries direct off a solar panel can be a risky business. This compact regulator protects the battery against overcharging which could easily damage batteries in some circumstances. It also prevents the battery from discharging at night and deep discharge - something that will extend battery life substantially. Installation is straight forward with just 3 wire pairs: solar panel, battery and load. Two status LED's are included to indicate load and charge states. Specifications: Nom voltage,12V •Max solar panel voltage, 24V •Max solar panel current, 2A •Overcharge volt limit, 14.2V •Discharge volt limit, 10.8V •Regulator consumption, 5mA Cat. MP-3120 **$69.95**

Car Alarm Back Up Battery Siren

Brand new small sized siren. Sound output 125dB. Size 80(L) x 70(W) x 92(H)mm including mounting brackets.

NEW in 98

Cat LA-8910 **$49.95**

Remote Controls Preprogrammed & Programmable

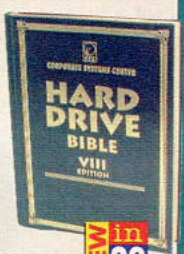
Cat. AR-1705 **$79.95**

Pre Programmed with LCD Display

Cat. AR-1700 **$34.95**

HARD DRIVE BIBLE

The ultimate book on hard drives. 430+ pages, Hardcover. See our catalogue for full details Cat. BC-1210



NEW in 98

$49.95

TURN YOUR SURPLUS STOCK INTO CASH!

Jaycar buys surplus/distress stock of most electronic products from components to built products. If you have marketable quantities of stock you need to clear contact Bruce Routley on Phone: 02 9743 5222 Fax: 02 9743 2066

VCR Alignment Tool Kit

NEW in 98

Kit includes: •3 reversable screwdrivers (see our TD2033) •7 x assorted head and guide aligners •VCR head puller •Retaining remover •Spring hook •8 pc hex key set with micor phillips head driver •Vinyl carry zip-up carry bag with strap (240x140x35mm)

Cat. TD-2050 **$79.95**

Video Enhancer / Stabiliser Kit

Refer: E A Nov. 1997 This kit will give you better quality copies when you dub from one video tape to another. See 98 Cat. page 3 for details.

NEW in 98

Cat. KA-1798 **$69.95**

Phone and Mains Filter

2 US phone sockets and 1 mains skt. Cat. MS-4025

Was $32.95 April $26.95

2 US phone sockets and 6 mains skts. Cat. MS-4035

Was $44.95 April $39.95

Miniature Analogue PIR

Pulse

This PIR incorporates a new analogue technology courtesy of a tiny SMD IC recently developed in the US. Unlike existing pulse count detectors, these new generation PIRs have the ability to count fractions of a pulse and not trigger the alarm. Supplied with wall mounting bracket with pivitol ball joint, mounting hardware and bonus screwdriver for terminal block wire fastening.This detector is smaller than most PIRs - it measures just 52 x 65 x 39mm! Cat. LA-5020

$34.95

JAYCAR ELECTRONICS

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JC25 Bookshelf Speaker Kit

NEW in 98

Refer: EA March 1998 Quote from Rob Evans of Electronics Australia Magazine. "In the review speakers were judged through a series of subjective and objective tests performed in a typical home environment. It soon became clear that these speakers delivered far more than the "reasonable" sonic performance I would have expected from a low cost bookshelf system, and this was in fact the first in a series of surprises from the JC25's. The overall sound was very smooth over a wide bandwidth..." "...delivered a convincing low end performance for their size with no sign of distress or frequency doubling effects from the bass driver when dealing with sustained low frequency signals. It was this observation that led me to the second of the JC25's surprises, and that was its ability to handle very high power levels with a minimum of fuss. In short the JC25's seem almost unburstable. In spite of their 50WRMS power rating, they can be pushed very hard without suffering from a significant increase in the apparent distortion level, in fact their ability to produce a clean sound while handling high power levels can be quite deceiving, as it happened my 60WRMS complained first..." "My preconceived ideas on how a low cost bookshelf system can sound were now well and truly shot down in flames, with the JC25's exceeding all of those expectations".

The JC25's use the Re/sponse 5" polypropylene cone woofer the superb Vifa D19 tweeters. The cabinets and crossovers are pre-built and the speaker cloth is already mounted to the removeable frame.

The power handling is 50WRMS with a frequency response of 60Hz to 20kHz +/-3dB, and a sensitivity rating of 87dB per watt/metre. Nominal impedance is 8 ohm. Cabinet details are available upon request.

SPEAKER KIT: Pair Cat. CS-2585 **$169 Pr**

Consists of: •2 x 5" Re/Sponse polypropylene woofers •2 x Vifa D19 dome tweeters •2 x pre-built crossovers with rear terminals •Jaybond speaker lining material •4 x bass reflex ports •mounting hardware & internal cable.

CABINET KIT: Pair Cat. CS-2586 **$199 Pr**

Consists of two pre-built cabinets constructed of high quality MDF and finished in black-grey oak. Size 187(W) x 197(D) x 287(H)mm. Speaker grille cloth pre-mounted on removeable frames.

Buy Together and Save $19

COMPLETE KIT $349 Pair

The "Full House" Power Driver Bit Set

All the weirdo driver bits in one go!! The set consists of 32, yes 32 of the driver bits that you don't normally see. You <u>don't</u> get any slotted, Phillips or Posidrive bits. You <u>do</u> get: •4 x Tri - wing, size 1, 2, 3, and 4 •9 x Torx (tamperproof), size T8, T10, T15, T20, T25, T27, T30 and T35 •4 x Pin drive (snake), size 4, 6, 8 and10 •6 x In - Hex (allen), *metric, size 2, 2.5, 3, 4, 5 and 6 •6 x In - Hex (allen), *imperial size 5/64", 3/32", 7/64", 1/8", 9/64" and 5/32" •3 x Torque Set, size 8, 9 and 10. *Tamperproof Torx works as normal Torx as well.*Tamperproof In - Hex drive type

Cat. TD-2035 **WERE $29.95** **$14.95**

"Son of Full House" Power Driver Bit Set

NEW in 98

During this year we found several new screw heads which are not in the "Full House" set. It comes as a 32 piece set with a magnetic hex driver bit in a plasticy-rubber holder/holster like its Dad. The colour is blue to distinguish it. Specifically, the moly steel set contains: •2 x "clutch drive" bits: 3/16" & 5/32" •5 x square drive: 5-0, 5-1, 5-2, 5-3 •8 x Hex (allen) imperial size: 1/16", 5/64", 3/32", 1/8", 5/32", 7/32", 3/16" & 1/8", •7 x Torx: T-10, T-15, T-20, T-25, T-27, T-30, T-40 •5 x Pozidrive No. 0, No 1, No. 2, No 3 •5 x slotted: 1/8", 3/32", 5/32", 3/16" & 1/4".

Cat. TD-2036 **$14.95**

Mini Super Car Tweeters

NEW in 98

These new super tweeters are incredibly small and they have a really cool mounting bracket that allows you to point the tweeter exactly where you want it. The tweeter dimensions are 33mm diameter and 15mm high.

The are supplied with 2 different mounting brackets. The first one is rubber coated steel, and is flexible. Simply screw one end into the back or the tweeter, and the other end to the door, cash, etc, and adjust the bracket so the tweeters point where you want it. Ideal for mounting tweeters in horrible places (eg sail area). The second mounting bracket is for in door mount where they can sit recessed. All hardware supplied. The tweeters use a mylar dome and a neodymium magnet. They handle about 80W RMS with the suggested crossover, which is at 8000Hz. They have a peak at around 8-10,000Hz, which is where you want it anyway.

Cat. CS-2205 **$65 Pair**

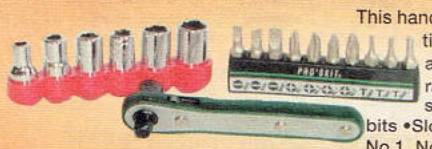
Super Car Tweeter Crossover

NEW in 98

These crossovers are designed for our new Mini Super Car Tweeters, but can be used on most super tweeters. It consists of a 3.3uF capacitor and a 0.10mH inductor mounted in a small plastic case with leads attached. The case measures 44(L) x 25(W) x 21(H)mm.

Cat. CX-2640 **$9.95pr**

17 Piece Offset Ratchet Driver Set



This handy tool set is ideal for getting into those tight places. Especially good for working around the car. The head tool has a ratchet & accepts both screwdriver bits & socket bits. Supplied with :- Screwdriver bits •Slotted - 4mm, 5mm, 6mm. •Phillips - No.1, No.2. •Posidrive - No.1, No.2. •Torx - 10mm, 15mm, 20mm. Socket bits •Slotted -5mm, 6mm, 7mm,8mm. •Phillips - 9mm, 10mm.

Cat. TD-2045 **Was $16.95 Now $12.95 Save $4**

JAYCAR WHOLESALE

All Jaycar products are available at very competitive wholesale prices. If you are tired of your current unreliable supplier, why not give Jaycar a try. You'll be pleasantly surprised.

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

MAIL ORDER - FREECALL FOR PHONE ORDERS 1800 022 888

8 SECOND KEYRING RECORDER

NEW in 98

This is a digital sound recorder that you can use for messages on the fly - shopping list info, meetings, ideas, etc.8 seconds doesn't sound much you say! You will be suprised that 8 seconds is more than enough for voice memos.

Cat. XC-0272 **$14.95**

650 CABLE TIES - MIXED CAN

NEW in 98

An excellent assortment of cable ties for hobbyists, automotive, marine or home gardening! This great pack's got the lot: 100 pcs x 100mm white, 200pcs x 100mm assorted colours, 300pcs x 200mm white, 50pcs x 285mm white.

Cat. HP-1208 **$19.95**

TURN YOUR SURPLUS STOCK INTO CASH!
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Ph: 02 9743 5222 Fax: 02 9743 2066

TALKING CALCULATOR ALARM CLOCK

Each keystroke is met with digitised speech, whilst each calculating function such as division and subtraction is clearly spoken. Calculation results are also spoken, including decimal points with the ability to repeat the result with the single touch of a button. Other features include adjustable volume (which can be switched off), & a clock with alarm.

NEW in 98

Cat. QM-7275 **$24.95**

Talking Up/Down Timer with Clock

This timer counts up or down and provides a verbal report every second or every hour, depending on the time period remaining. At the end of the event, one of six alarms will sound. Other features include 3 independant timer functions, auto timing repeat, talking clock plus memory to store frequently used timing.

NEW in 98

Cat. XC-0284 **$19.95**

TALKING INDOOR OUTDOOR THERMOMETER

With this unique thermometer, you can wake up to a voice report of both the inside and outside temperatures every 15 minutes for the first hour after the alarm goes off. Features include: •hourly temperature announcement •high and low temperature alerts •daily high/low temperatures •specific period min/max temperatures •adj. volume •C° and F° selection. Sensor is also included, with a handy 3m long wire lead.

NEW in 98

Cat. QM-7215 **$34.95**

TALKING CALENDAR THERMOMETER ALARM CLOCK

This is a desk top calendar that also displays time and temperature. A large push button at the top of the unit activates time & temperature voice announcements. The LCD displays one full calendar month along with the time and temperature.

NEW in 98

Cat. XC-0282 **$29.95**

Surface Mount Hinged Speaker Brackets

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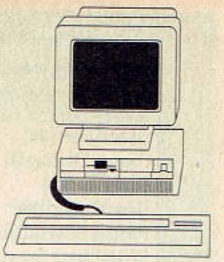
BY JASON COLE



DirectX 5: why you need it

Aimed originally at the 3D games & multimedia markets, DirectX is designed to simplify and speed up complicated tasks such as rendering 3D graphics and playing sounds. Let's find out more about it.

3D graphics in consumer PCs are becoming commonplace, driven mainly be the demand for high-quality 3D graphics in games. Quite a few high-performance 3D accelerators and combination 3D/2D graphics cards are now available at reasonable prices.

However, a 3D graphics card is not the only thing you need for fancy 3D graphics. You also need special software known as an API (application programming interface) in order to take advantage of all the card's features. One of the best known APIs is DirectX.

DirectX was created by Microsoft so that a programmer can more effectively utilise specific hardware components in your PC. But why do we need some other program to help programmers use the hardware?

Well, the problem with programming for computers is that there are many different types of hardware out there. This makes it impossible to produce a single piece of software that fully utilises the various features of all this hardware. To explain, let's say that you're a games programmer and the game you're creating is 3D-based. This means that you need to issue specific instructions to the video card in order to create 3D graphics. Unfortunately, the commands used for one type of video card are different to those used for most others.

This means that your software would have to be able to identify each of the many different 3D graphics cards that are now in existence and utilise the appropriate code for the model detected. In theory, this could be done but it's clearly impractical because of the amount of software that would be involved. A typical game would have to be installed from three or four CDs and would take up a lot of room on your hard disc drive.

One way around this is to design the game so that it only uses generic program codes. Unfortunately, this would severely compromise the graphics quality, regardless of the quality of the video card. The graphics on a $400 3D video card would be no better than those on a $100 card. Sure, the $400 3D card would be fast but who cares if the game looks substandard?

In fact, this is how things were done up until a few years ago. Many games were simply designed for the "S3" video chip. That's great for S3 chip owners but what about other chips?

DirectX was designed to overcome this problem. It's so-called "Low Level" functions are based on Application Programming Interfaces, or API's for short. API's control functions from 2D graphics acceleration to mouse and joystick inputs.

DirectX is, in fact, split up into four areas which are a part of the "Foundation Layer". These are Direct3D, DirectSound, DirectDraw and DirectInput. These areas use software drivers to communicate between the software and the hardware. This is called the "Hardware Abstraction Layer" or HAL.

As a result, programmers can write a set of instructions that are standard and the HAL will then translate these instructions so that they can be used by the hardware. But what if the hardware doesn't support the features that the program requires?

A typical example of this is 3D games on a 2D video card. In cases like this, DirectX uses a "Hardware Emulation Layer", or HEL. This will decipher the instructions and generate a virtual 3D card from the 2D card. Of course, this will be slower than

Tip Of The Month

Most people know that if you want to delete something in Windows 95 you simply drag the file onto the Recycle Bin icon. But did you also know that you can print files by dragging them onto a printer icon?

If you have one or more printers, all you have to do is create shortcuts to them on the desktop. This done, you can print files simply by dragging them onto the appropriate icon. When you do this, the application that created the file is automatically launched and the file downloaded to the printer.

In case you're wondering, you can also open a document by dragging it (or a shortcut to it) onto the application's icon (or onto a shortcut to the application). Of course, in most cases it will be easier to open the document by double-clicking it.

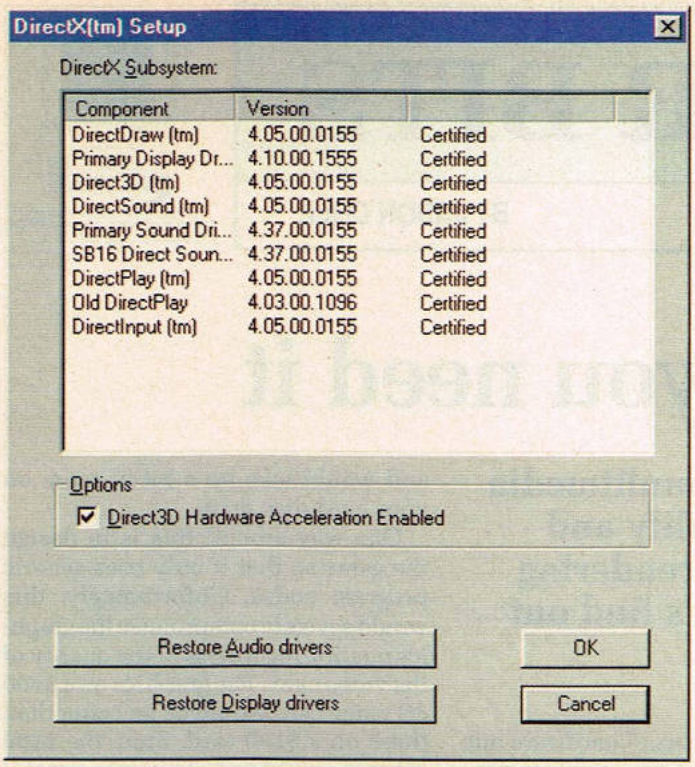


Fig.1: the Add/Remove Programs feature in Control Panel lets you restore your previous audio and video drivers.

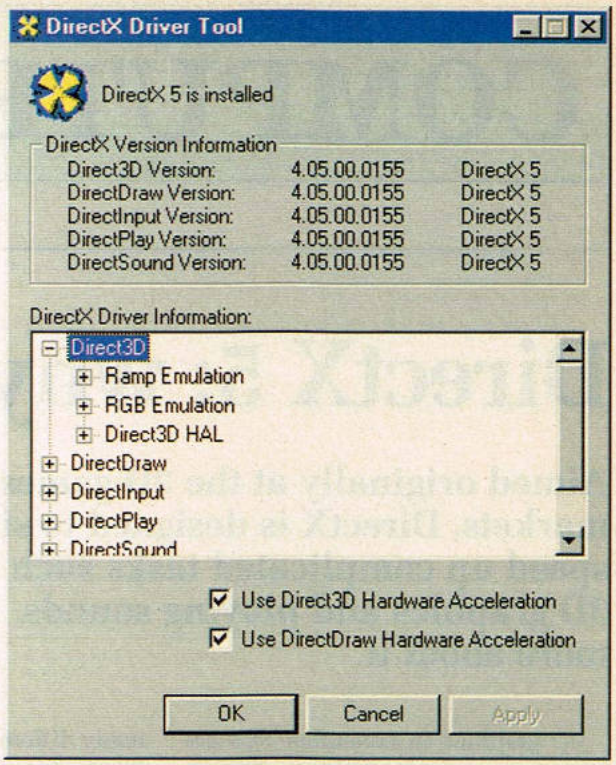


Fig.2: you can check the status of your DirectX drivers by double-clicking Dxtool.exe.

using a real 3D card but it does allow everyone to play 3D games regardless of what video card he or she has.

It should be pointed out that not all devices are supported by DirectX. The hardware maker must supply a set of drivers for DirectX in order to take advantage of the specialised functions that DirectX has to offer.

Fortunately, most of the latest 3D cards support DirectX. But that's not the end of the story; there are other APIs besides DirectX, the two main ones being OpenGL and Glide. In fact, Quake – one of the biggest selling games of all time – supports OpenGL exclusively for 3D acceleration and new titles are being added all the time. For this reason, many graphics card vendors also provide OpenGL drivers for their latest offerings. Glide works only with 3Dfx-based cards.

As well as providing graphics compatibility, DirectX also provides compatibility between different multimedia elements (eg, graphics and sound). Fairly obviously, the computer must be able to provide simultaneous graphics and sound. Originally, this required several API's for the video and sound cards, generally from different manufacturers. After all, not everyone uses a Creative sound card with a Creative video card. In fact, I use a Creative sound card with an Octek video card. These are both fairly high-quality components but the APIs for the sound card may not work well with the API's for the video card, thereby causing conflicts and slowing down either the video image or the sound.

Once again, DirectX overcomes this problem. It has a "Media Layer" and this to is split up into several areas: Direct3D retained mode, DirectPlay, DirectAnimation, and DirectShow. Note that DirectShow and DirectAnimation are now built into Microsoft Internet Explorer 4.0, which allows web site developers to utilise the enhanced feature's of DirectX. This can also reduce the size of the page that is downloaded and thus the download time – an important consideration for web users.

The "Media Layer" of DirectX works in a similar way to the "Low Level" functions described earlier and enables programmers to co-ordinate a multitude of different multimedia elements. This is done by using a set of API's that allow the different elements to function together as though they were a single application. As a result, different elements can work together and run smoothly with the correct timing (eg, a 2D character on top of a video clip with some added sound).

Installing DirectX

If you're into games or other multimedia activities with fancy graphics, then DirectX 5.0 is a must. It can be downloaded from the Microsoft website and is also often available on the CD-ROMs that come with some computer magazines. It is also supplied with some games programs.

During the installation, the install program checks for "certified" video and audio card drivers. If it finds them, it recommends upgrading them with new drivers (which are included with the install program). You simply click "Yes" to upgrade or "No" to keep your existing drivers. By the way, you can easily revert to your previous drivers via the Add/Remove Programs feature in Control Panel – see Fig.1. You can also disable or enable Direct 3D Hardware Acceleration.

If you want to check the status of the DirectX Driver Tool, go to the folder where DirectX is installed and double-click Dxtool.exe. A dialog box similar to that shown in Fig.2 will appear. This dialog box also enables you to turn Direct 3D and DirectDraw hardware acceleration on or off. SC

Silicon Chip Bookshop

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Installation, Reception & Repair. By Derek J. Stephenson. First published 1991, reprinted 1997 (4th edition).

This is a practical guide on the installation and servicing of satellite television equipment. The coverage of the subject is extensive, without excessive theory or mathematics. 383 pages, in hard cover at $55.00.

Guide to TV & Video Technology

By Eugene Trundle. First published 1988. Second edition 1996.

Eugene Trundle has written for many years in *Television* magazine and his latest book is right up date on TV and video technology. 382 pages, in paperback, at $39.95.

Servicing Personal Computers

By Michael Tooley. First published 1985. 4th edition 1994.

Computers are prone to failure from a number of common causes & some that are not so common. This book sets out the principles & practice of computer servicing (including disc drives, printers & monitors), describes some of the latest software diagnostic routines & includes program listings. 387 pages in hard cover at $75.00.

The Art of Linear Electronics

By John Linsley Hood. Published 1993.

This is a practical handbook from one of the world's most prolific audio designers, with many of his designs having been published in English technical magazines over the years. A great many practical circuits are featured – a must for anyone interested in audio design. 336 pages, in paperback at $55.00.

Digital Audio & Compact Disc Technology

Produced by the Sony Service Centre (Europe). 3rd edition, published 1995.

Prepared by Sony's technical staff, this is the best book on compact disc technology that we have ever come across. It covers digital audio in depth, including PCM adapters, the Video8 PCM format and R-DAT. If you want to understand digital audio, you need this reference book. 305 pages, in paperback at $69.00.

Power Electronics Handbook

Components, Circuits & Applications, by F. F. Mazda. Published 1990.

Previously a neglected field, power electronics has come into its own, particularly in the areas of traction and electric vehicles. F. F. Mazda is an acknowledged authority on the subject and he writes mainly on the many uses of thyristors & Triacs in single and three phase circuits. 417 pages, in soft cover at $59.95.

Surface Mount Technology

By Rudolph Strauss. First published 1994.

This book will provide informative reading for anyone considering the assembly of PC boards with surface mounted devices. Includes chapters on wave soldering, reflow soldering, component placement, cleaning & quality control. 361 pages, in hard cover at $99.00.

Radio Frequency Transistors

Principles & Practical Applications. By Norm Dye & Helge Granberg. Published 1993.

This book strips away the mysteries of RF circuit design. Written by two Motorola engineers, it looks at RF transistor fundamentals before moving on to specific design examples; eg, amplifiers, oscillators and pulsed power systems. Also included are chapters on filtering, impedance matching & CAD. 235 pages, in hard cover at $95.00.

Electronics Engineer's Reference Book

Edited by F. F. Mazda. First published 1989. 6th edition.

This just has to be the best reference book available for electronics engineers. Provides expert coverage of all aspects of electronics in five parts: techniques, physical phenomena, material & components, electronic design, and applications. The sixth edition has been expanded to include chapters on surface mount technology, hardware & software design, semi-custom electronics & data communications. 63 chapters, soft cover at $125.00.

Audio Electronics

By John Linsley Hood. Published 1995.

This book is for anyone involved in designing, adapting and using analog and digital audio equipment. Covers tape recording, tuners & radio receivers, preamplifiers, voltage amplifiers, power amplifiers, the compact disc & digital audio, test & measurement, loudspeaker crossover systems and power supplies. 351 pages, in soft cover at $55.00.

Understanding Telephone Electronics

By Stephen J. Bigelow. Third edition published 1997 by Butterworth-Heinemann.

This is a very useful text for anyone wanting to become familiar with the basics of telephone technology. The 10 chapters explore telephone fundamentals, speech signal processing, telephone line interfacing, tone and pulse generation, ringers, digital transmission techniques (modems & fax machines) and much more. Ideal for students. 367 pages, in soft cover at $49.95.

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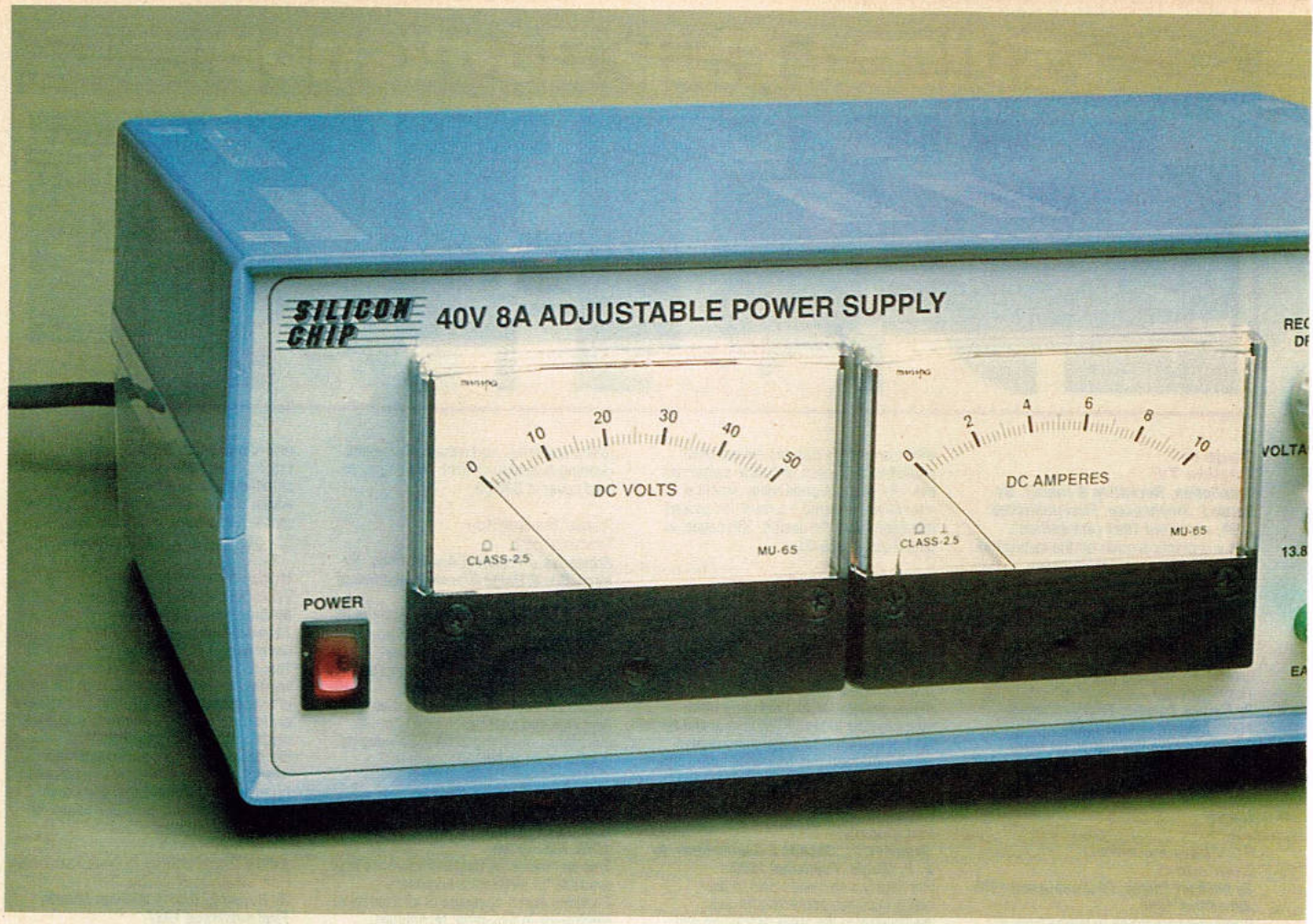


Revised 40V 8A power supply is short-circuit proof

Do you need a big power supply? One which will deliver lots of current but is short circuit proof? Well this is for you. Its output is adjustable from 0-45V and it can deliver up to 8 amps.

Pt.1: By JOHN CLARKE

Specifications

Output voltage	150mV-45V
Output current	8A below 35V, 6.6A at 40V
Load regulation	0.5%
Ripple and noise	60mV p-p at 8A
Current limit adjustment	1A-8A
Over temperature cutout	80°C

IT MIGHT NOT LOOK all that big from the photos but trust us, this is a really big power supply, delivering up to 280 watts, depending on the voltage and current settings. In the past, a power supply with that much output capability would be a monster and it would weigh a tonne as well.

But this is a switchmode design and so it is highly efficient. The result is that it does not need a really big power transformer and big heatsinks. It uses the same operating principles as the switchmode power supplies employed in millions of personal computers.

Before we go too much further we should state that this power supply is a revised and updated version of one we published in the January & February 1992 issue of SILICON CHIP. Externally, the revised design looks much the same as the original version and it has much the same features but its circuit is completely different. While it uses the same power transformer and main bridge rectifier, from there on it is different.

Features

The revised power supply is housed in a large plastic instrument case and has generously sized meters for voltage and current. There are two knobs to adjust the output: one for voltage and one for current. Just below the voltage knob is a toggle switch which allows the supply to deliver a fixed 13.8V which is handy if you are working on any automotive device.

Below the current adjust knob is a pushbutton switch which allows the maximum current to be set and below that again is the load switch. This is another handy feature because it allows the voltage output to be set precisely before the load is connected.

The ammeter shows current from 0-10A and has three modes of operation. Normally this meter shows the current delivered to the load but when the current set switch is pressed and with the load switched off, it shows the current limit setting. This is variable from 1-8A using the current adjust knob.

Reserve current

When the power supply is delivering current to a load you can press the current set switch to display the reserve current available. This is the difference between the set current limit and the current delivered to the load. It is a handy feature which can allow you to set the current limit to a certain value over the normal quiescent current drawn by the load.

Above each of the voltage and current adjust knobs is a LED to indicate "regulator dropout" and "current overload", respectively. As its name suggests, the regulator dropout indicator shows when the difference between the load voltage setting and the unregulated DC input voltage is insufficient to allow the regulator to work properly. This will normally only occur when the output voltage and current are both high.

When the regulator dropout LED indicator comes on, you can keep using the supply and no harm will occur because it is fully protected but the hum and noise superimposed on the output will be quite a lot higher than normal.

Similarly, when the supply goes into current overload or exceeds the current output setting, it will produce an audible squealing which gives you a further warning that its settings are being exceeded.

Three binding post terminals are provided for the supply's output, red for positive, black for negative and green for Earth. Neither side of the supply is tied to Earth so it may be operated as a fully floating supply or

Main Features

- Large voltage and current meters
- Adjustable current limit
- Load switch
- Regulator dropout indication
- Current overload indication
- Variable or fixed 13.8V output
- Can be used as a current source
- Over temperature cutout
- Floating output can be earthed on + or - terminal
- Reserve current (headroom) indication

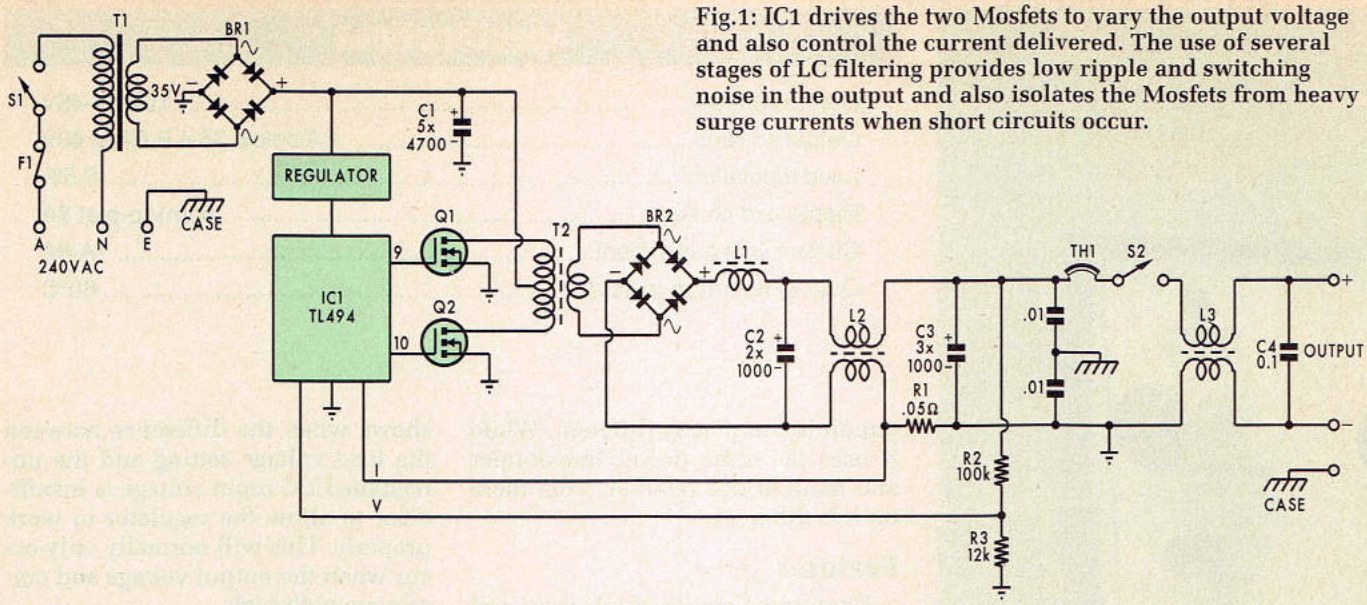


Fig.1: IC1 drives the two Mosfets to vary the output voltage and also control the current delivered. The use of several stages of LC filtering provides low ripple and switching noise in the output and also isolates the Mosfets from heavy surge currents when short circuits occur.

either the red or black terminals can be linked to the green Earth terminal if you desire.

New design

While the original design was basically sound, there were a number of problems with it. First, it used a special optical fibre link between the control and regulator sections and this component was often difficult to obtain. Second, it had current foldback protection which caused problems when the supply was called upon to drive big incandescent lamps or DC motors; as soon as these loads were connected, the initial surge current caused the supply to go into foldback and so no power would be delivered.

Third, the main power Mosfet used for voltage regulation turned out to be prone to destruction under short circuit conditions and with high power delivered to the load there was a tendency for the toroidal inductor to overheat.

In addition, some users also wanted the ability to operate the supply as a constant current source and that is not possible in a circuit with foldback protection.

Hence, we had a number of reasons to reassess the design and to produce a new version which was considerably more rugged. This new design is now short circuit proof and only runs

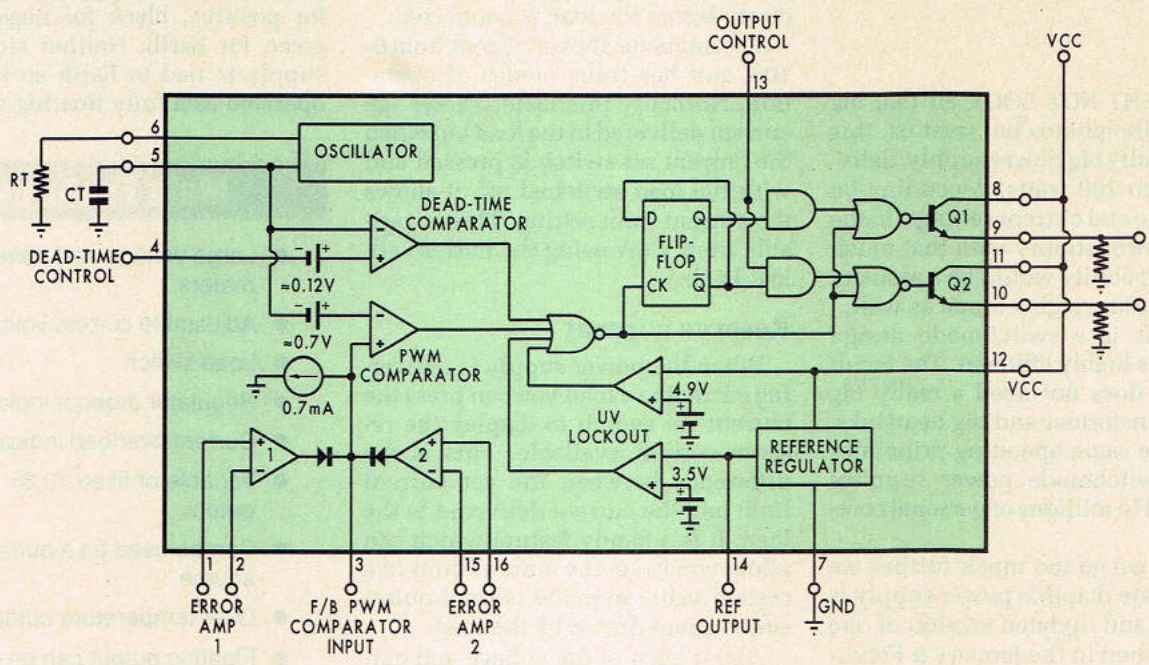


Fig.2: block diagram of the TL494 switchmode controller. It contains an oscillator, pulse width modulation (PWM) comparator, error amplifiers and output drivers at pins 9 & 10. Other refinements include a dead-time control and under-voltage (UV) lockout.

warm when delivering high currents. The supply can easily drive DC motors without causing current overload on startup.

Fig.1 shows the simplified circuit for the new 40V 8A adjustable power supply. It is a switchmode circuit with two Mosfets (Q1 & Q2) used to drive transformer (T2). By varying the duty cycle of Q1 & Q2 we can control the output voltage.

In essence, the circuit operation is as follows. Transformer T1 delivers 35VAC to the bridge rectifier BR1 and its output is filtered with C1 which comprises five 4700µF capacitors. The result is smoothed DC of about 50V. A regulator reduces this to 12V to feed IC1, the TL494 switchmode controller.

IC1 controls a push-pull switchmode converter comprising the two switching Mosfets Q1 & Q2, transformer T2, bridge rectifiers D1-D4, inductor L1 and C1, which is two 1000µF capacitors.

Mosfets Q1 & Q2 operate pretty much like any other push-pull switchmode converter. When Q1 is switched on, the full +50V is applied across the top half of the primary winding of T1 and so, by transformer action, -50V appears across the other half of the transformer winding and at the drain of Mosfet Q2. When Q2 switches on, the reverse action occurs across the transformer primary. Transformer action also causes current to flow in the secondary winding and via the bridge rectifier BR2 to the LC filter consisting of L1 & C2.

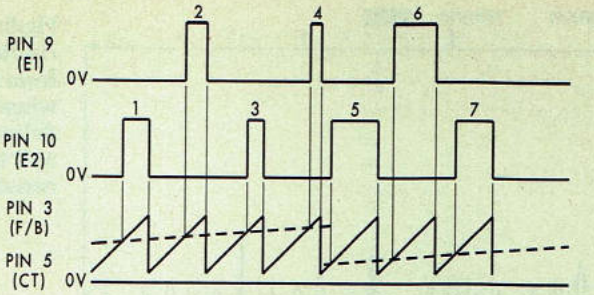


Fig.3: these waveforms demonstrate the operation of IC1. The top two waveforms are the gate signals for Mosfets Q1 & Q2, at pins 9 & 10. The lowest waveform is the oscillator waveform (CT) with the feedback voltage superimposed on it.

Following C2 is another LC filter consisting of L2 & C3 and this further filters the output of bridge rectifier BR2. The voltage developed across C3 is determined by the load current and the length of time that Q1 & Q2 are alternately switched on. The duty cycle is always less than 50% for each Mosfet but it can be a lot less than that, when the load current is low and the required output voltage is also low.

IC1 monitors the voltage produced across C3 using voltage divider resistors R2 & R3 and adjusts the duty cycle of the switching signal applied to Q1 & Q2, to obtain the voltage required.

Similarly, the output current from C3, which flows to the load via LC filter L3 & C4, is monitored by resistor R1. If the current limit is exceeded, IC1 reduces the duty cycle of the switching Mosfets and this in turn reduces the voltage and hence the current.

Importantly, even though IC1 acts to control the output voltage and current by continuously adjusting the switching signal, the reason why this new circuit can withstand repeated short circuits is that the three LC fil-

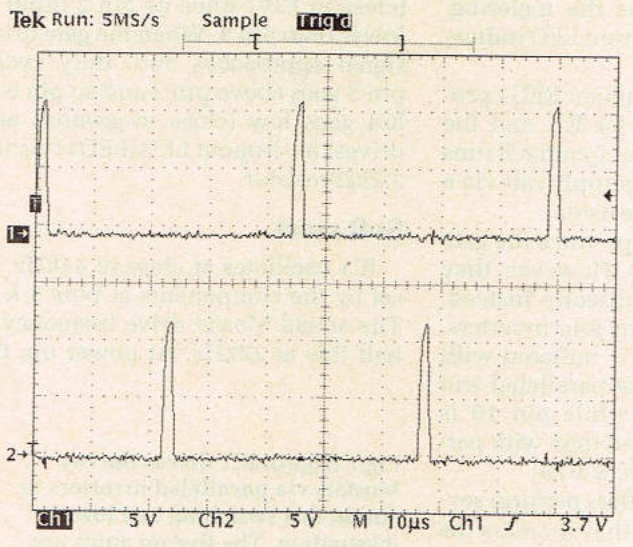


Fig.4: these are the gate signals to Q1 (top trace) and Q2 (lower trace) when the supply is delivering low voltage and low current.

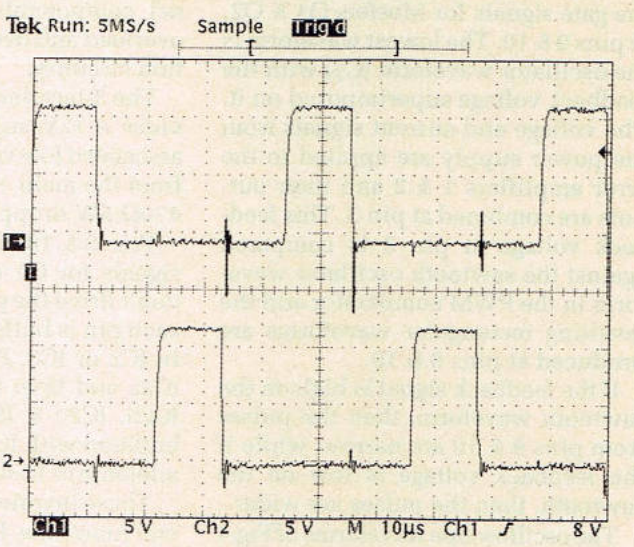


Fig.5: much wider gate signals are applied to Q1 and Q2 when the supply delivers higher voltage and current to the load.

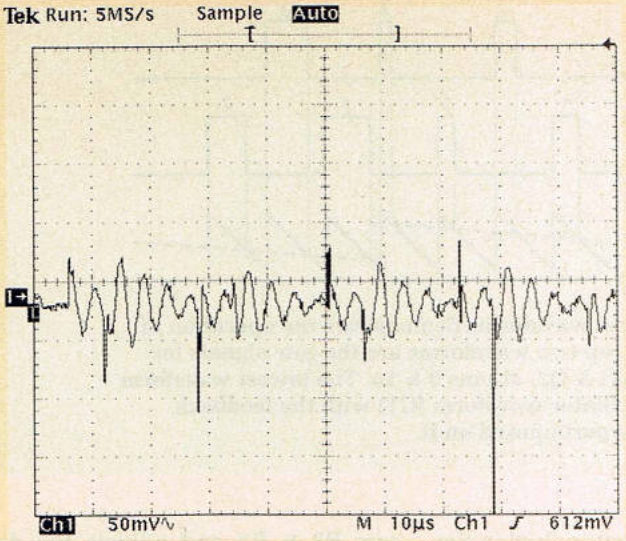


Fig.6: output ripple and noise from the supply when it is delivering 8A at 35V to a resistive load.

ters (L1, C2, L2, C3, L3 & C4) provide very good isolation between the load and Mosfets Q1 & Q2. No matter what peak currents might be drawn by overloading, the LC filters smooth it all out so that the Mosfets do not have to supply high instantaneous currents.

Fig.2 shows the internal workings of IC1. It contains an oscillator, pulse width modulation (PWM) comparator, error amplifiers and output drivers at pins 9 & 10. Other refinements include a dead-time control and under-voltage (UV) lockout.

The basic operation of IC1 is shown in Fig.3. The top two waveforms are the gate signals for Mosfets Q1 & Q2, at pins 9 & 10. The lowest waveform is the oscillator waveform (C_T) with the feedback voltage superimposed on it. The voltage and current signals from the power supply are applied to the error amplifiers 1 & 2 and their outputs are combined at pin 3. This feedback voltage at pin 3 is compared against the sawtooth oscillator waveform in the PWM comparator and the resulting rectangular waveforms are produced at pins 9 & 10.

If the feedback signal is high on the sawtooth waveform, then the pulses from pins 9 & 10 are narrow, while if the feedback voltage is low on the sawtooth, then the pulses are wider.

The oscilloscope waveforms of Fig.4 show the gate signals to Q1 (top trace) and Q2 (lower trace). These are quite narrow pulses which occur when the supply is delivering low voltage and low current. Fig.5 shows much wider gate signals, representing a higher voltage and current to the load.

Fig.6 shows the output ripple from the supply when it is delivering 8A at 35V to a resistive load.

Circuit details

Fig.7 shows the full circuit of the revised power supply. While it looks a good deal more complicated than the simple diagram of Fig.1, you should still recognise the main supply chain from T1 through T2, L1, L2 & L3, along the top of the circuit diagram. The main differences are associated with IC1, showing all the external components plus the metering, overload and overcurrent LED indication circuitry.

The 3-terminal regulator REG1 provides a 12V supply for IC1 and the associated low voltage circuitry. It runs from the main +50V supply rail via a 470Ω 5W dropping resistor.

Pins 9 & 10 of IC1 produce the gate signals for Q1 & Q2. However, they don't drive the gates directly. Instead, each pin is buffered by four inverters, in IC2 or IC3. Pin 9 is buffered with IC2a and then by the paralleled trio IC2b, IC2c & IC2d, while pin 10 is buffered with IC3a and then with paralleled trio IC3b, IC3c & IC3d.

These inverter/buffers perform several functions. First, they increase the gate drive signal to the full 12V swing of the supply rail. Second, they "square up" the gate signals to produce fast pulse rise-times and fall-times and at the same time high current drive to the gate capacitance of the Mosfets. IC2 & IC3 have their supply decoupled with 0.1µF capacitors to prevent supply lead inductance affecting the drive signals.

The gates of Q1 & Q2 are each driven via a 47Ω resistor and these slightly slow the switching times, to reduce electromagnetic interference. A series diode and 150V zener diode is connected between the gate and drain of each Mosfet to protect them against transients. If a voltage spike of more than 150V occurs at the drain of Q1, for example, ZD1 conducts to turn the Mosfet momentarily on to safely clamp the transient. Thus the voltage spike is limited to about 155V, as set by the zener voltage plus the series diode, plus the turn-on voltage of the Mosfet gate.

Dropout detection

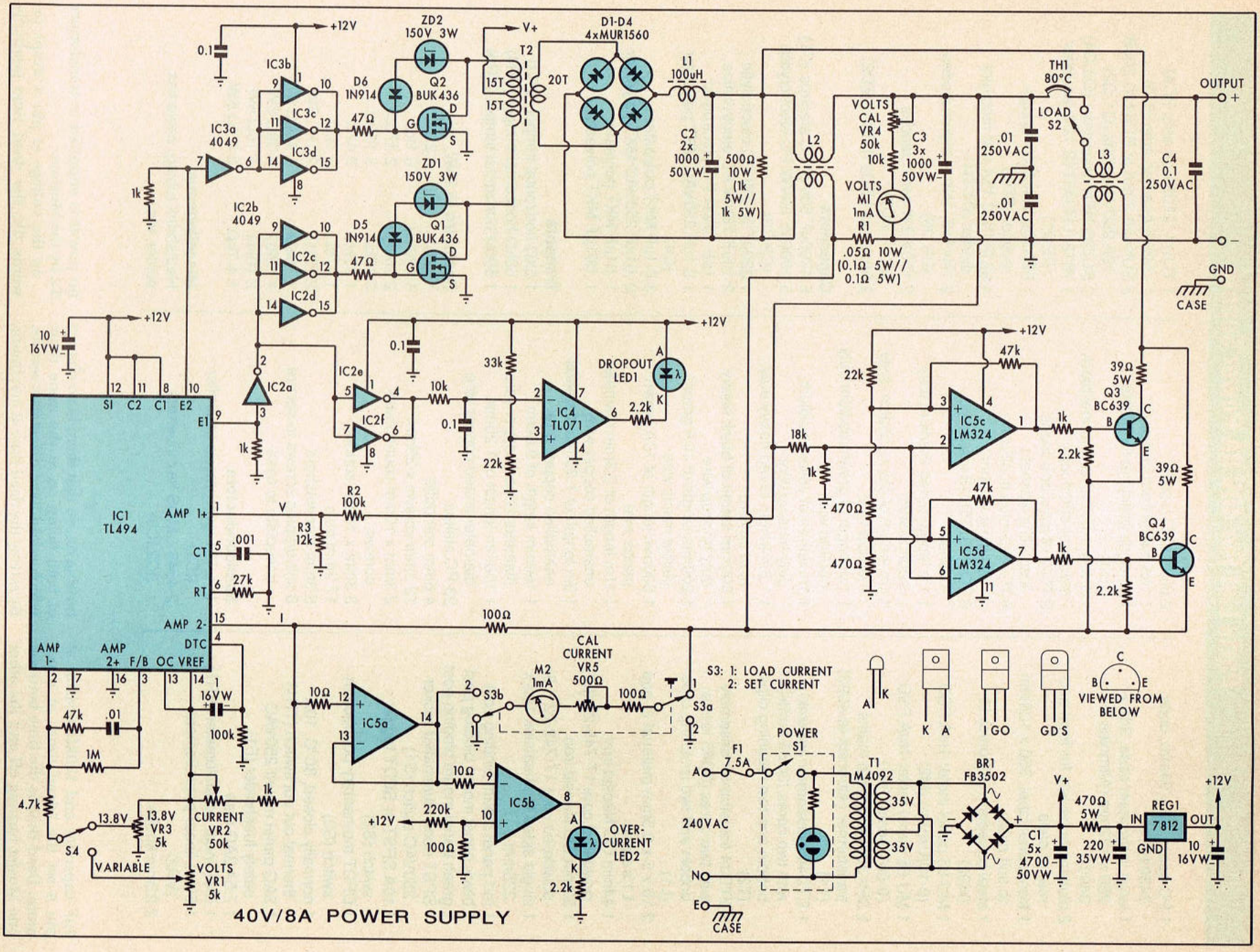
Inverters IC2e & IC2f buffer the pin 2 output of IC2a; ie, the gate drive signal to Q1. This signal approaches 50% duty cycle when the power supply is called upon to deliver full power. A 10kΩ resistor and 0.1µF capacitor filter the pulse signal to produce a DC voltage which represents the "average" value of the waveform. This approaches 6V when the gate drive is close to 50% duty cycle. The inverting input (pin 2) of op amp IC4 monitors this voltage and compares it to the +4.8V at pin 3 set by the 33kΩ and 22kΩ resistors across the 12V supply.

Normally, the output of IC4 is high (close to 12V) since its pin 2 input is lower than pin 3. When the gate drive signal approaches 50% duty cycle, pin 2 goes above pin 3 and so pin 6 of IC4 goes low (close to ground) and drives the dropout LED (LED1) via the 2.2kΩ resistor.

Soft start

IC1 oscillates at close to 44kHz, as set by the components at pins 5 & 6. The actual Mosfet drive frequency is half this at 22kHz. At power up, the

Fig.7 (right): IC1 drives the two Mosfets via paralleled inverters to obtain fast switching and low dissipation. The five op amps are there to provide minimum loading (IC5c & IC5d), current limit drive to the meter (IC5a), dropout indication (IC4) and current limit indication (IC5b).


+12V
0.1
IC3b
IC3c
IC3d
IC3a 4049
1k
ZD2 150V 3W
D6 1N914
Q2 BUK436
47Ω
ZD1 150V 3W
D5 1N914
Q1 BUK436
IC2b 4049
IC2c
IC2d
V+
T2
15T
15T
20T
D1-D4 4xMUR1560
L1 100uH
C2 2x 1000 50VW
500Ω 10W (1k 5W// 1k 5W)
L2
VOLTS CAL VR4 50k
10k
C3 3x 1000 50VW
VOLTS MI 1mA
R1 .05Ω 10W (0.1Ω 5W// 0.1Ω 5W)
TH1 80°C
LOAD S2
.01 250VAC
.01 250VAC
L3
C4 0.1 250VAC
OUTPUT +
OUTPUT -
GND
CASE
10 16VW
IC2a
IC2e
IC2f
0.1
10k
33k
22k
IC4 TL071
DROPOUT LED1
2.2k
IC1 TL494
SI C2 C1 E2
E1
AMP 1+
CT
RT
AMP 2-
DTC
AMP 1-
AMP 2+
F/B
OC
VREF
R2 100k
R3 12k
.001
27k
100Ω
47k
IC5c LM324
IC5d LM324
18k
470Ω
39Ω 5W
Q3 BC639
Q4 BC639
1 16VW
100k
47k
.01
1M
4.7k
13.8V
13.8V VR3 5k
S4
VARIABLE
CURRENT VR2 50k
VOLTS VR1 5k
10Ω
IC5a
IC5b
CAL CURRENT VR5 500Ω
M2 1mA
S3b
S3a
S3: 1: LOAD CURRENT
2: SET CURRENT
220k
100Ω
OVER-CURRENT LED2
2.2k
A K
K A
I GO
GDS
B C E
VIEWED FROM BELOW
POWER S1
F1 7.5A
240VAC
N
E
CASE
T1 M4092
35V
35V
BR1 FB3502
C1 5x 4700 50VW
470Ω 5W
220 35VW
REG1 7812
IN
OUT
GND
10 16VW
40V/8A POWER SUPPLY

Parts List For 40V 8A Power Supply

1 PC board, 80 x 94mm, code 04304981
1 large instrument case, 355 x 250 x 122mm (Altronics H-0490)
2 aluminium panels for front and rear of case
1 front panel label, 350 x 120mm, to suit case
1 steel baseplate (Altronics H-0492)
1 MU-65 panel meter 1mA FSD (0-10A scale) (M2)
1 MU-65 panel meter 1mA FSD (0-50V scale) (M1)
1 35V 300VA toroidal mains transformer (Altronics M-4092) (T1)
1 ETD44 transformer assembly with two cores (3C85 ferrite), 1 bobbin and two retaining clips (T2)
1 ETD34 transformer assembly with two cores (3C85 ferrite), 1 bobbin and two retaining clips (L1)
2 10 x 5 x 0.5mm material to gap L1's cores
1 44mm OD Neosid iron powdered core 17-745-22 (L2)
1 33mm OD Neosid iron powdered core 17-742-22 (L3)
1 single sided fan heatsink 105 x 225mm
1 red panel mount binding post
1 black panel mount binding post
1 green panel mount binding post
1 SPST neon illuminated rocker 250VAC switch (S1)
1 10A SPST or SPDT toggle switch (S2)
1 DPDT momentary pushbutton switch (S3)
1 normally closed, 80°C, 10A thermal cut out switch (TH1)
1 3AG panel mount 250VAC safety fuseholder (F1)
1 7.5A 3AG fuse
1 5kΩ linear potentiometer (VR1)
1 50kΩ linear potentiometer (VR2)
2 22mm knobs
2 5mm LED bezels
1 10A mains cord and plug
1 cordgrip grommet for mains cord
1 3-way 10A mains terminal block
7 solder or crimp lugs
2 TO-218 mica or silicone insulating washers
4 TO-220 mica or silicone insulating washers
6 TO-220, TO218 insulating bushes
1 1m length of red medium duty hookup wire
1 1m length of black medium duty hookup wire
1 1m length of green medium duty hookup wire
1 1m length of yellow medium duty hookup wire
1 1.5m length of red heavy duty hookup wire
1 500mm length of black heavy duty hookup wire
1 200mm length of 10A green/yellow mains wire
1 500mm length of 10A brown mains wire
1 11m length of 0.8mm diameter enamelled copper wire
1 3m length of 1.25mm diameter enamelled copper wire
1 160mm length of 0.8mm diameter tinned copper wire
1 100mm length of 1.25mm diameter tinned copper wire
23 PC stakes
4 6mm standoffs
12 3mm screws x 25mm
2 3mm x 10mm countersunk screws
3 3mm x 10mm screws
17 3mm nuts
5 3mm star washers
8 self-tapping screws to secure baseplate to case

Semiconductors
1 TL494 switchmode controller (IC1)
2 4049 CMOS hex inverters (IC2,IC3)
1 TL071, LF351 op amp (IC4)
1 LM324 quad op amp (IC5)
2 BUK436-200A or BUK436-200B 19A 200V Mosfets (Q1,Q2)
2 BC639 NPN transistors (Q3,Q4)
1 7812, LM340T12 12V regulator (REG1)
1 FB3502 35A 200V bridge rectifier (BR1)
4 MUR1560 15A fast recovery diodes (D1-D4)
2 1N4148, 1N914 signal diodes (D5,D6)
2 150V 3W zener diodes (ZD1,ZD2)
2 5mm red LEDs (LED1,LED2)

Capacitors
5 4700µF 50VW PC electros (C1)
5 1000µF 50VW PC electrolytics (C2,C3)
1 220µF 35VW PC electrolytic
2 10µF 16VW PC electrolytics
1 1µF 16VW PC electrolytic
1 0.1µF 250VAC MKT polyester (C4)
3 0.1µF MKT polyester
2 .01µF 250VAC MKT polyester
1 .01µF MKT polyester
1 .001µF MKT polyester

Trimpots
1 5kΩ horizontal trimpot (VR3)
1 50kΩ horizontal trimpot (VR4)
1 500Ω horizontal trimpot (VR5)

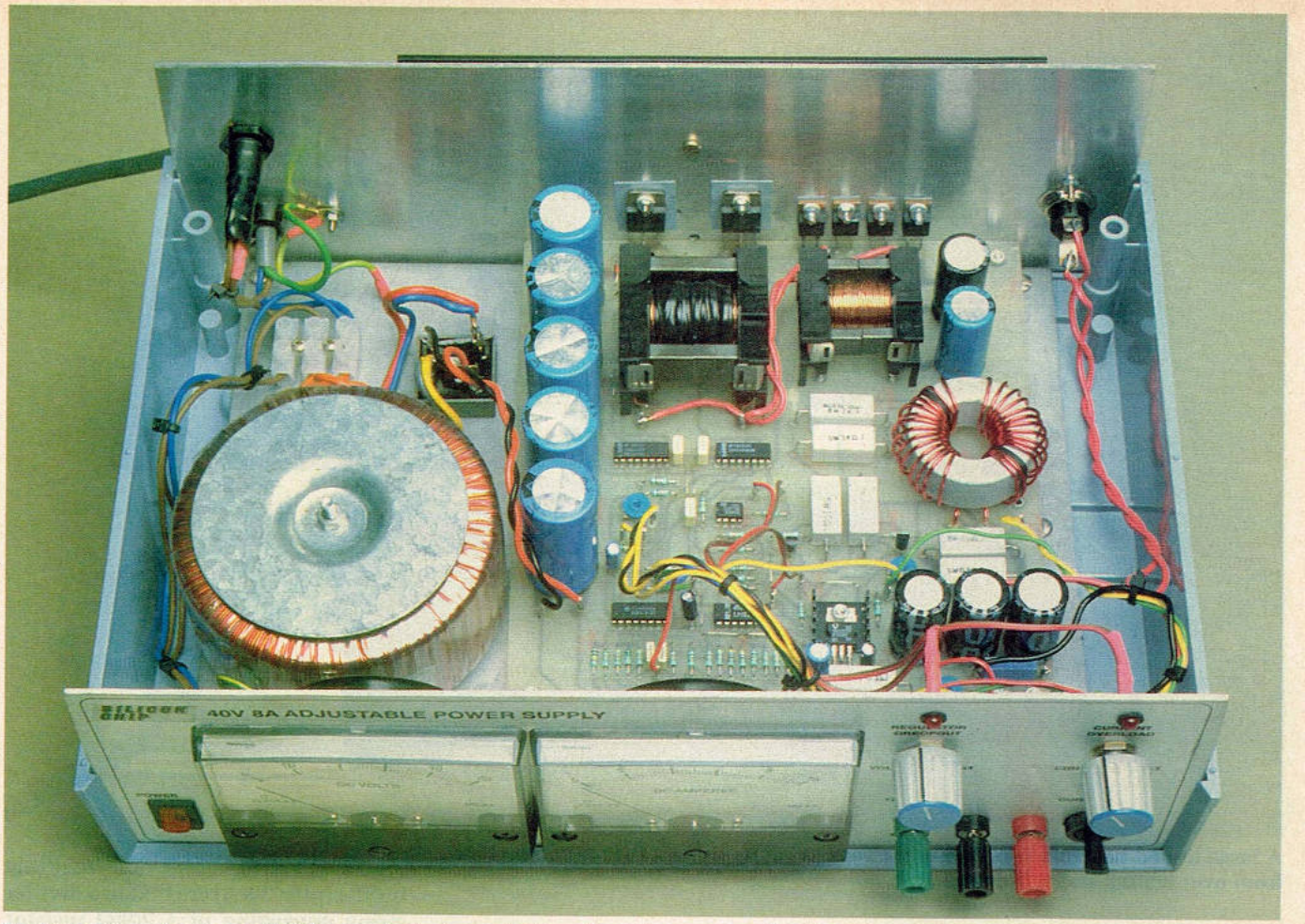
Resistors (0.25W, 1%)

1 1MΩ	4 2.2kΩ
1 220kΩ	6 1kΩ
2 100kΩ	2 470Ω
3 47kΩ	3 100Ω
1 33kΩ	2 47Ω
1 27kΩ	2 10Ω
2 22kΩ	2 1kΩ 5W
1 18kΩ	1 470Ω 5W
1 12kΩ	1 39Ω 5W
2 10kΩ	1 10Ω 5W
1 4.7kΩ	2 0.1Ω 5W

Miscellaneous
Heatshrink tubing, cable ties, solder, etc.

1µF capacitor and 100kΩ resistor at pin 4 set the "dead time" at maximum. Dead time is the time between one Mosfet turning off and the other turning on, so that there is no chance of both being on at the same time, which could have disastrous results. By setting the dead time at maximum, no power is supplied to transformer T2 by the Mosfets.

As the voltage at pin 4 drops towards 0V, the dead time gradually



Most of the parts are mounted on a single large PC board, so the construction is straightforward (full details in Pt.2 next month).

decreases until it is at a minimum and so the Mosfets provide a "soft start", bringing the set voltage up gradually.

Error amplifier

Pin 14 of IC1 is a +5V reference for the error amplifiers. The output voltage of the power supply is fed to a voltage divider consisting of 100kΩ and 12kΩ resistors and monitored at pin 1 (see Fig.2). The inverting input at pin 2 connects to the wiper of switch S4 via a 4.7kΩ resistor. This resistor and the 1MΩ resistor between pins 2 & 3 set the amplifier gain at 213. A 47kΩ resistor and series .01µF capacitor roll off the high frequency response of the amplifier to a maximum gain of about 11 above 16Hz.

The wiper of switch S4 connects either to potentiometer VR1 (the voltage control) or to VR3. Both potentiometers are connected to the +5V reference. VR3 is adjusted to set the fixed 13.8V output while VR1 sets the variable output. If VR1 is set to give 5V at its wiper, the switchmode circuit acts to produce the same voltage at pin 1. The power supply therefore produces 46.66V because this is reduced by the 12kΩ and 100kΩ resistive divider to 5V at pin 1.

For intermediate settings of VR1, the circuit maintains this same voltage at pin 1. Since VR1's wiper can vary between +5V and 0V, the output voltage can be varied from 46.66V down to almost 0V.

Current limiting

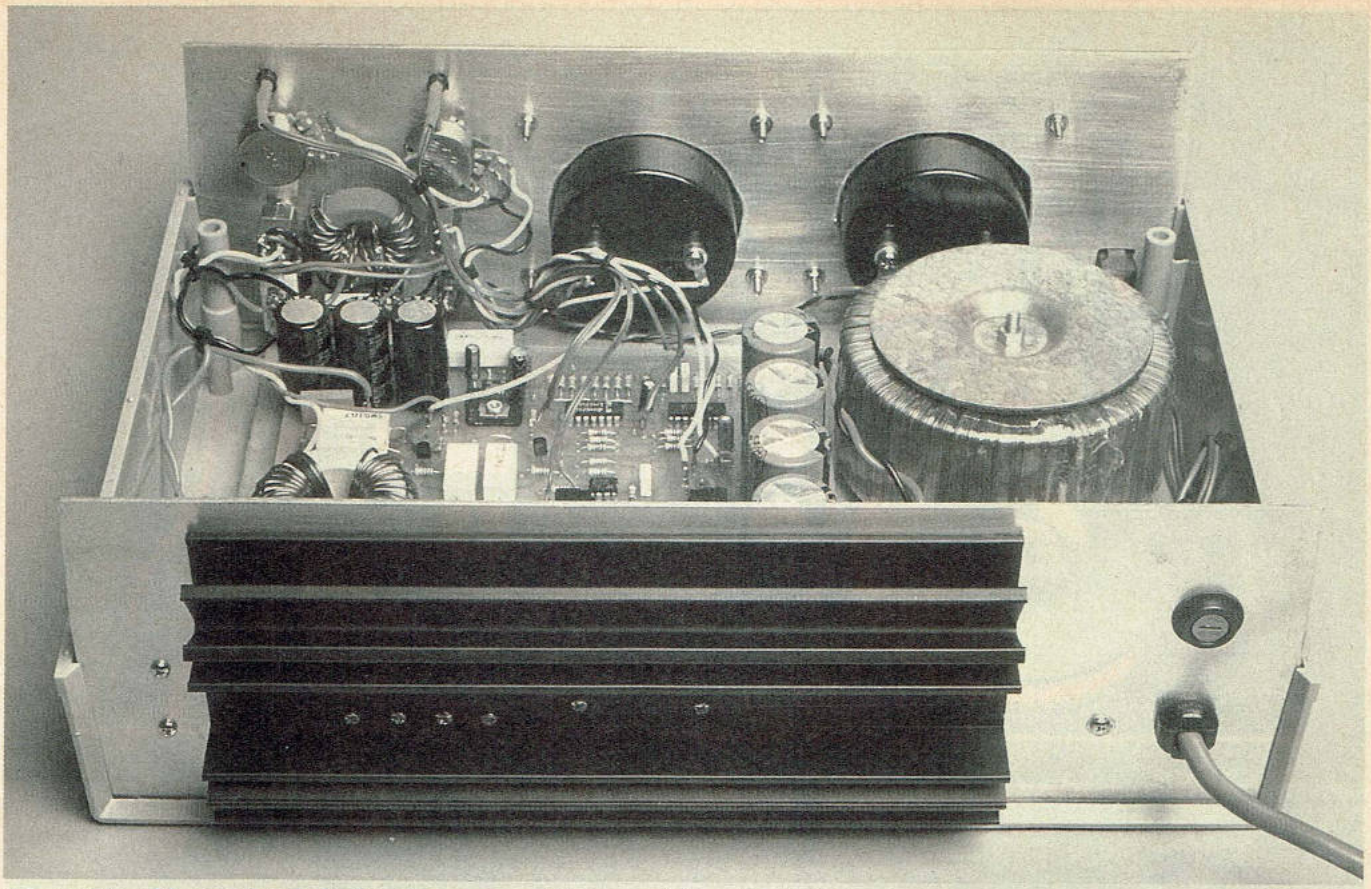
The current delivered by the power supply is detected using two paralleled 0.1Ω 5W resistors and the resulting voltage is monitored at pin 15 of IC1 via a 100Ω resistor.

VR2 sets the current limit and operates as follows. With no current flowing through the two paralleled 0.1Ω resistors, pin 15 is set to some small positive voltage by VR2. When current is drawn from the supply, the voltage developed across the 0.1Ω resistors acts to pull pin 15 lower. If pin 15 is pulled below 0V, which is lower than pin 16, then the output of error amplifier 2 goes high to reduce the pulse drive to the Mosfets. This limits the current.

When no current is flowing through the 0.1Ω resistors, VR2 can be adjusted to provide from +0.45V down to 0.01V. The resistance of the two paralleled 0.1Ω resistors is 0.05Ω and so 8A will produce a 0.4V drop across them. Thus, if VR1 is adjusted to set pin 15 to 0.4V then current limit will occur at 8A. When VR2 is set to give 0.05V at pin 15, current limit will occur at 1A.

A 1mA meter, M2, is used as the ammeter. When switch S3 is in position 1, the meter is connected across the 0.1Ω current sensing resistors but in series with trimpot VR5 and a 100Ω resistor. The meter therefore displays the load current.

We've already discussed how pin 15 of IC1 is biased by VR2 to set the current limit. The voltage at pin 15 is buffered with unity gain amplifier IC5a and its output drives meter M2 when



A large finned heatsink is bolted to the rear panel to prevent the output devices from overheating and self-destructing.

switch S3 is in position 2. The meter thereby indicates the current limit setting in amps, when the load switch S2 is off (ie, no current actually flowing to the load).

But if the load switch S2 is on, the load current produces a voltage drop across the 0.1Ω resistors and this is subtracted from the current limit voltage applied to pin 15 of IC1. In this condition, when S3 is in position 2, the ammeter displays the difference between the load current and the current limit. In other words, it shows how much more current can be delivered to the load before limiting occurs. This can be a handy feature when driving some loads where the current swings need to be controlled.

As discussed previously, current limiting occurs when pin 15 of IC1 approaches 0V. Pin 15 is buffered by op amp IC5a and its output, as well as driving the ammeter, is connected to op amp IC5b which is connected as a comparator. Its non-inverting input at pin 10 sits at about +5mV, as set by the 220kΩ and 100Ω resistors across the 12V supply. When pin 9 goes below pin 10, which happens as the circuit goes into current limiting, pin 8 of IC5b goes high to drive overcurrent indicator LED2 via a 2.2kΩ resistor.

Minimum loading

Op amps IC5c & IC5d and transistors Q3 & Q4 provide a minimum load for the power supply. This is necessary to ensure that the regulator works reliably at low values of load current. If we don't provide a minimum load, the switching pulses to Q1 & Q2 become extremely narrow and tend to become irregular as the circuit tries to maintain a fixed voltage.

This minimum loading is achieved with three sets of resistors. Firstly, two 1kΩ 5W resistors in parallel are permanently connected across the supply (near C2 on the circuit of Fig.7) and these provide sufficient current drain for voltage settings above 10V.

For voltage settings below 10V, Q3 is used to switch in a 39Ω 5W resistor while for settings below 5V, Q4 switches in a 10Ω 5W resistor.

Op amps IC5c & IC5d are connected as comparators to control the switching of Q3 & Q4. The non-inverting inputs (pins 3 & 5) are tied to a divider string consisting of a 22kΩ resistor and two 470Ω resistors. The inverting inputs (pins 2 & 6) of each op amp monitor the supply output voltage via a voltage divider consisting of 18kΩ and 1kΩ resistors.

The resistive divider strings are set so that IC5d's output is high when the power supply voltage is between 0V and 5V and IC5c's output is high when the voltage is between 0V and 10V. When IC5d's output is high, it drives the base of Q4 via a 1kΩ resistor to connect the 10Ω resistor across the supply, while IC5c's high output drives the base of Q3 via its 1kΩ resistor to connect it to the power supply rails.

Note that IC5c & IC5d both have 47kΩ feedback resistors. These provide some hysteresis to prevent the output from oscillating at the verge of switching.

Note that the 10Ω, 39Ω and 1kΩ load resistors are connected across the supply before the 0.1Ω current sensing resistors. This prevents them from affecting the ammeter reading or the current limit setting.

Next month, we will give the full construction details. **SC**

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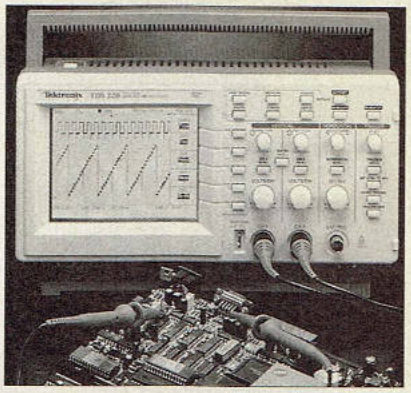

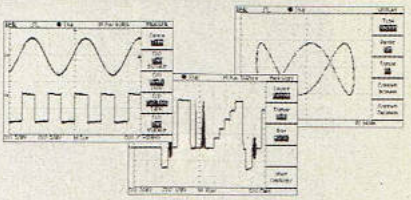

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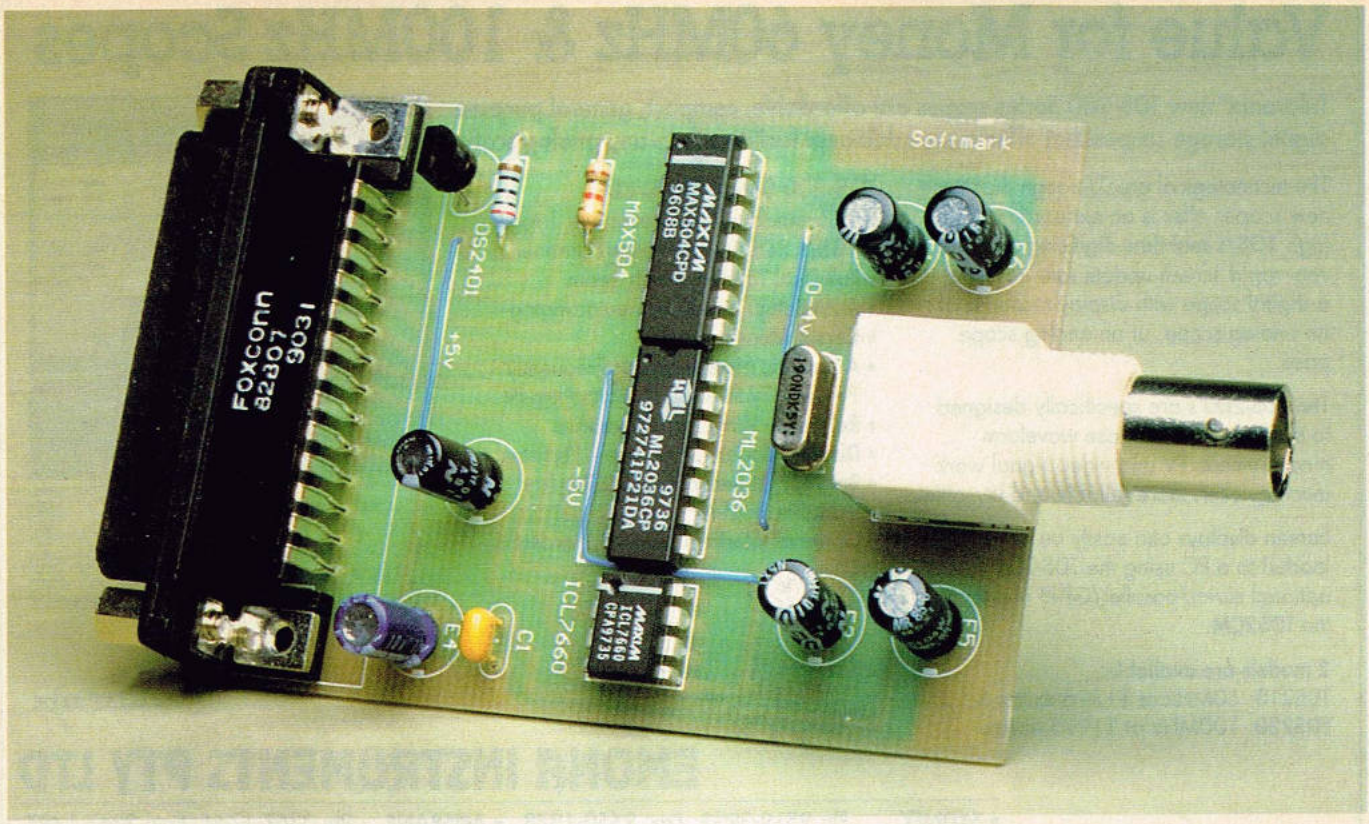


PC-controlled 0-30kHz sinewave generator

Based on the ML2036 audio generator IC, this simple project hooks up to your PC's parallel port and generates a sinewave output from 0-30kHz. The output frequency and level are controlled via the on-screen display.

By MARK ROBERTS

This simple audio oscillator uses just a handful of parts and will only take about 10 minutes to assemble. It's low in cost too (just $30), since you don't need to buy fancy digital displays, or frequency and level controls, or an output level meter – at least not in hardware form. Instead, that's all taken care of by the software which generates a "virtual" instrument panel on your PC's monitor.

Fig.1 shows what the on-screen display looks like. As can be seen, it has a digital frequency display (with up to five digits), digital and analog output level meters, and controls to set the output frequency and level. The output frequency is set by either rotating the Tuning knob (by dragging it with the mouse) or by clicking the up and down buttons to change the reading in 1Hz, 10Hz or 100Hz steps.

You can also change the output frequency by clicking at any point on the circumference of the Tuning knob. When you do this, the red dot on the tuning knob jumps to the new setting and the display changes accordingly.

The signal level can be varied from 0-4V in 10mV steps by clicking another pair of up/down buttons. Alternatively, for more rapid changes in output level, you can drag the slider bar between these two buttons. The accompanying 3-digit display shows the output level (in Vp-p), or you can read the level off the analog meter.

Immediately to the right of the output level control are three other buttons. The top button (shown as 100Hz in Fig.1) lets you toggle between 1Hz, 10Hz and 100Hz frequency steps. The middle button is labelled "Help" but no help functions were available at

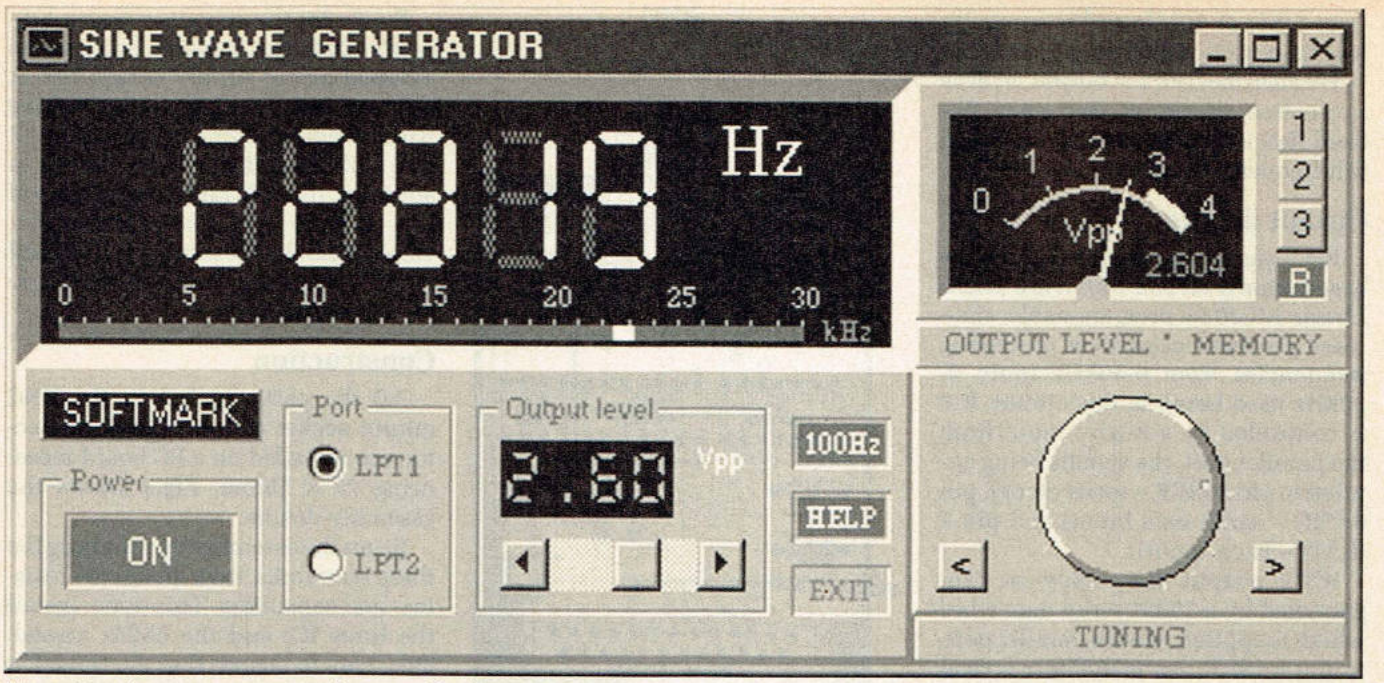


Fig.1: the sinewave generator is controlled via this virtual instrument panel which is generated by the software.

Specifications

Frequency Range: 0-30kHz sinewave

Frequency Steps: 1Hz, 10Hz & 100Hz

Output Level: 0-4Vp-p (.01V steps)

Frequency Response: flat from 0-30kHz

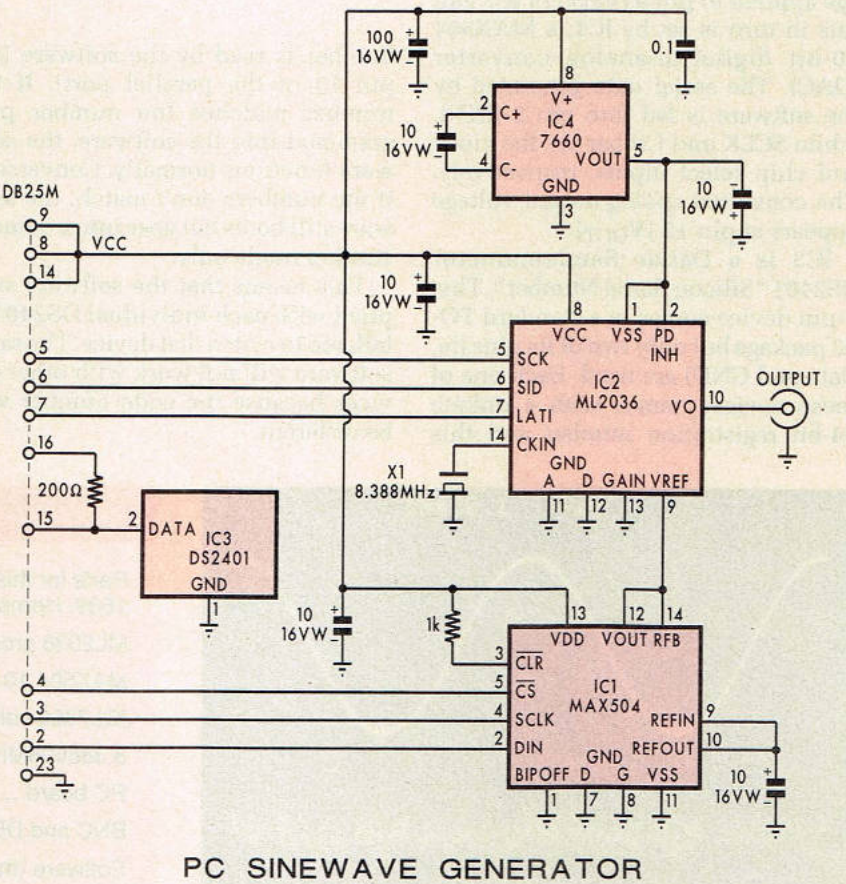
Total Harmonic Distortion: less than 0.5% from 2Hz to 30kHz @ 1.066V RMS

the time of writing. The third button, labelled Exit, shuts down the program.

There are also three memory channels, situated immediately to the right of the analog level meter. You can program three spot frequencies (eg, 1kHz, 10kHz and 20kHz) into these channels, each with a different output level if so desired. Programming is easy – you simply click a memory button, set the frequency and output level, and then click the R/W button (below the memory buttons).

Performance

Figs.4 & 5 show the performance details. As shown in Fig.5, the total harmonic distortion at 1V RMS is less than 0.5% over the frequency range



PC SINEWAVE GENERATOR

Fig.2: the circuit is based on IC2 which is an ML2036 sinewave generator. It's output frequency is set by the voltage applied to its V_{REF} input from IC1, a 10-bit digital-to-analog converter. The output from IC1, in turn, depends on the data applied to it via the parallel port of the computer.

from 20Hz to 30kHz and is generally less than 0.2% above 1kHz.

We also checked the output level as a function of output frequency. It's dead flat, with 0dB variation over the full frequency range.

Circuit details

Fig.2 shows the circuit details. It's based mainly on IC2 which is a Micro Linear ML2036 programmable sinewave generator capable of producing frequencies from 0-50kHz (only 0-30kHz used here). In this circuit, IC2 is controlled by a 3-wire input from the parallel port, the signals being applied to pin 5 (SCK – serial clock), pin 6 (SID – serial data input) and pin 7 (LATI – latch input).

IC2's output frequency is programmed by a 16-bit serial data word which is applied, via the parallel port, to pin 6 (SID). An 8.388MHz crystal between pin 14 and ground provides the internal clock signal and sets the upper frequency output to 30kHz.

The output level is set by the voltage applied to pin 9 (V_{REF}) of IC2 and this in turn is set by IC1, a MAX504 10-bit digital-to-analog converter (DAC). The serial data generated by the software is fed into pin 2 (DIN), while SCLK and CS-bar are the clock and chip select inputs, respectively. The converted analog output voltage appears at pin 12 (V_{OUT}).

IC3 is a Dallas Semiconductor DS2401 "Silicon Serial Number". This 3-pin device comes in a standard TO-92 package but only two of its pins (ie, Data and GND) are used. Each one of these devices comes with a unique 64-bit registration number and this number is read by the software (via pin 15 of the parallel port). If the number matches the number programmed into the software, the software functions normally. Conversely, if the numbers don't match, the software still boots but goes into a demonstration mode only.

This means that the software supplied with each individual DS2401 is tailored to match that device. The same software will not work with other devices because the code number will be different.

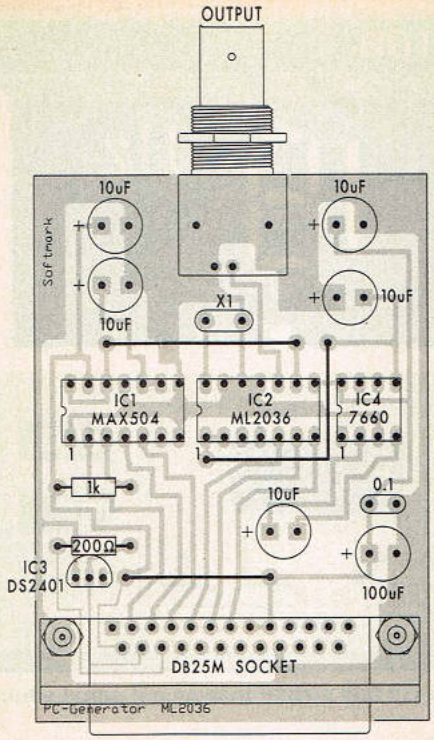


Fig.3: install the parts on the PC board as shown on this wiring diagram.

Power for the circuit is derived directly from the parallel port, so no external power supply is required. A +5V rail is derived from pin 9 of the parallel port and this is fed to pins 13 and 8 of IC1 and IC2, respectively. In addition, the +5V rail is fed to pin 8 of IC4, a 7660 switched-capacitor inverter. This device produces a -5V rail at its pin 5 output and this is fed to pins 1 & 2 of IC2.

Construction

All the parts, including the BNC output socket and the DB25 connector, are installed on a PC board measuring 77 x 55mm. Fig.3 shows the assembly details.

Begin the assembly by installing the three wire links, then install the resistors and capacitors. This done, install the three ICs and the 8MHz crystal. Take care to ensure that the three ICs are correctly oriented (they all face in the same direction) and don't get the MAX504 mixed up with the ML2036.

Finally, complete the assembly by fitting the BNC socket and the DB25M connector. Check that both these devices lie flat against the PC board before soldering any of their pins. Go over your work and check carefully for mistakes before connecting the unit to a computer, ready for testing. You can either plug the unit directly into the parallel port or connect it via a DB25 male-to-female cable.

Installing the software

The software comes on three floppy discs and runs under Windows 3.1x, Windows 95 and Windows NT. You install it by running setup.exe on the

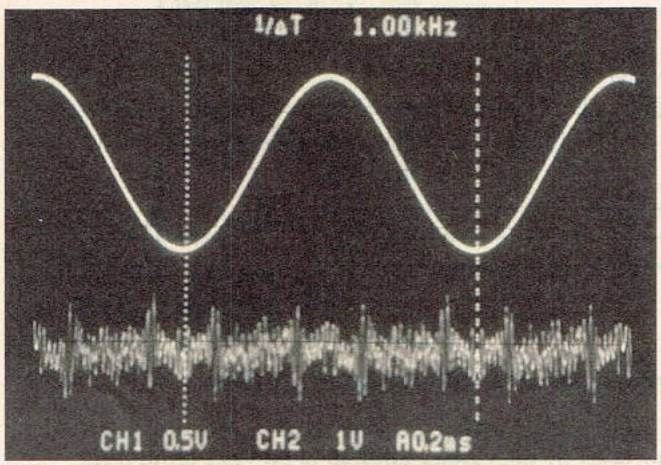


Fig.4: this scope shot shows the residual hash at the output of the generator, as well as the distortion. The upper waveform shows the output signal at 1kHz.

Where To Buy Parts

Parts for this design are available from Softmark, PO Box 1609, Hornsby, NSW 2077 (phone/fax 02 9482 1565).

ML2036 programmable sinewave generator	$18
MAX504 10-bit digital-to-analog converter	$9
ICL7660 voltage converter	$4
8.388608MHz crystal	$3
PC board	$10
BNC and DB25M connectors	$7
Software (three discs) with DS-2401	$32
Optional LPT2 card	$15

Payment by cheque or money order only. Please add $5 for postage. Note: the software associated with this design is copyright to Softmark.

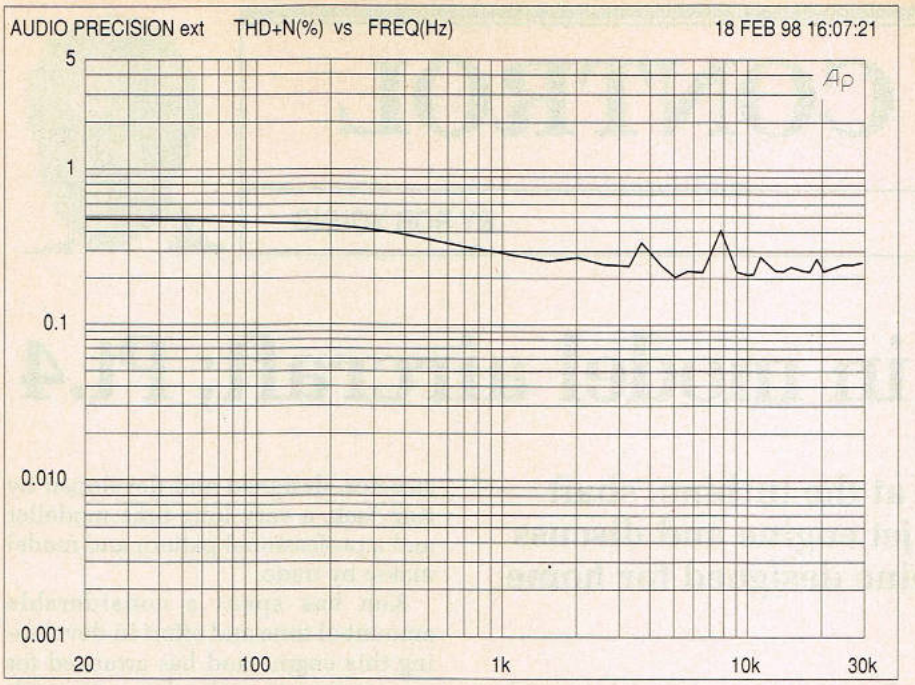


Fig.5: this graph shows the total harmonic distortion of the generator over the range from 20Hz to 30kHz.

first disc and following the on-screen instructions. In Windows 95, you click Start, Run and then type A:\setup.exe in the space provided (assuming that the floppy disc is in the A: drive). The installer program creates the appropriate program group and installs a shortcut in the Start menu.

In Windows 3.1x, you click File, Run and type A:\setup.exe. Alternatively, you can double-click the setup.exe file from within File Manager or, in Windows 95, from the Explorer.

When you boot the software, it opens a dialog box that lets you select between two printer ports (LPT1 and LPT2). LPT2 is the initial default but most users will need to select LPT1. You then click OK to bring up the instrument panel shown in Fig.1. Initially, all the displays will be off, since the Power is off. You turn the display on by clicking the Power button.

By the way, once you've selected a port, the software always boots up with the new port as the default, unless you change it again.

It's now just a matter of checking that everything works. Check that you can vary the output frequency and level and that all the other "controls" work correctly. The default frequencies programmed into the memory buttons are 1kHz, 2kHz & 3kHz.

The output of the oscillator is best checked on a scope. If you don't have a scope, feed the signal into an audio amplifier and listen while the unit is swept over the frequency range. Of course, you won't be able to hear anything much above about 15kHz, depending on your hearing and the loudspeaker used, but this is still a good check that the unit is working. **SC**

Parts List

1 PC board, 77 x 55mm
1 PC-mount DB25M connector
1 PC-mount BNC connector
1 3-disc software package

Semiconductors
1 MAX504 10-bit DAC (IC1)
1 ML2036 programmable sinewave generator (IC2)
1 DS2401 silicon serial number (IC3)
1 ICL7660 switched capacitor inverter (IC4)
1 8.388608MHz crystal (X1)

Capacitors
1 100µF 16VW PC electrolytic
5 10µF 16VW PC electrolytic
1 0.1µF monolithic

Resistors (0.25W, 5%)
1 1kΩ
1 200Ω

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- **P.C.B. Guillotine**
- **P.C.B. Material – Negative or Positive acting**
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RADIO CONTROL

BY BOB YOUNG

Jet engines in model aircraft; Pt.4

This month we will look at the turbine, shaft and tail cone of a model jet engine and discuss an Australian-made turbine designed for home construction.

I am absolutely fascinated each month by the uncertainty of outcome which each column will have due to factors outside my control. Reader feedback takes some really interesting turns and can lead to all sorts of unforeseen results.

The Mk.22 transmitter series was a classic in this regard and the Speed1B controller even more so. The Mk.22 system just kept growing and developing due to reader demands. Just recently, I have put a programmable AM-FM transmitter module (a world first to my knowledge) into production. It came about solely as a result of reader feedback.

The Speed1B speed control module continues to amaze me, even though it was done nearly seven years ago and is now quite old by electronic standards. The latest adventure for that little device is to power full-size electric bicycles in Asia.

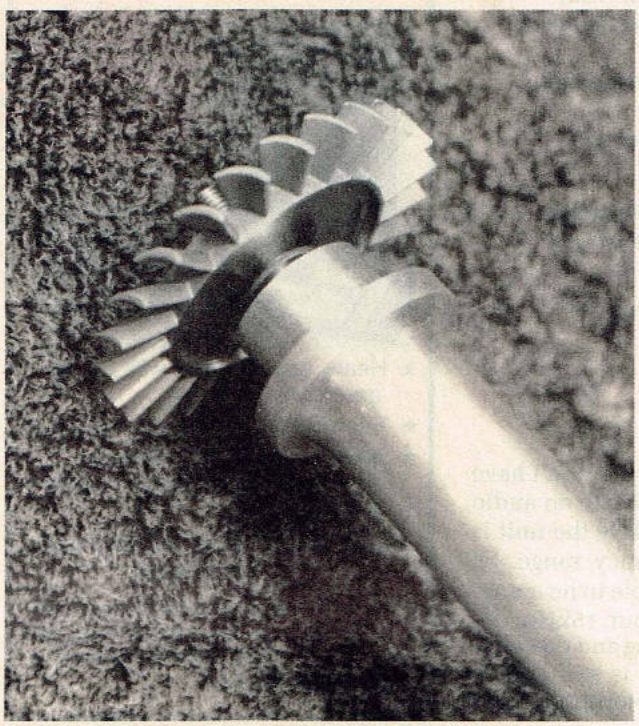
The same thing is now happening with the gas turbine series. As a result of reader feedback, I learned of an Australian turbine for the home constructor, designed and developed by Ken Jack, a very long time modeller and a professional pattern and model maker by trade.

Ken has spent a considerable amount of time and effort in developing this engine and has arranged for an associate to make the parts available. One of the photos in this article shows the major component groups of one of Ken Jack's motors. In the foreground is the shaft with turbine and compressor fitted. Immediately behind is the inlet, diffuser combustion chamber, nozzle guide vanes (NGV) and tail cone. In the background is the outer housing.

Another photo clearly shows the turbine with the blades profiled in a definite aerodynamic shape. A very complex machining operation is need to achieve this.

On a different note, Fig.1 shows an exploded view of the Golden West Models FD/67 turbine which is available fully assembled and tested from Klaus Breitkreutz, in Sydney. This is a popular American engine which runs on kerosene.

It is the engine in the Mirage featured in the January 1998 issue of SILICON CHIP. Excitement is mounting in modelling circles in regards to turbines and all that remains is for the price to fall to a more accessible level.

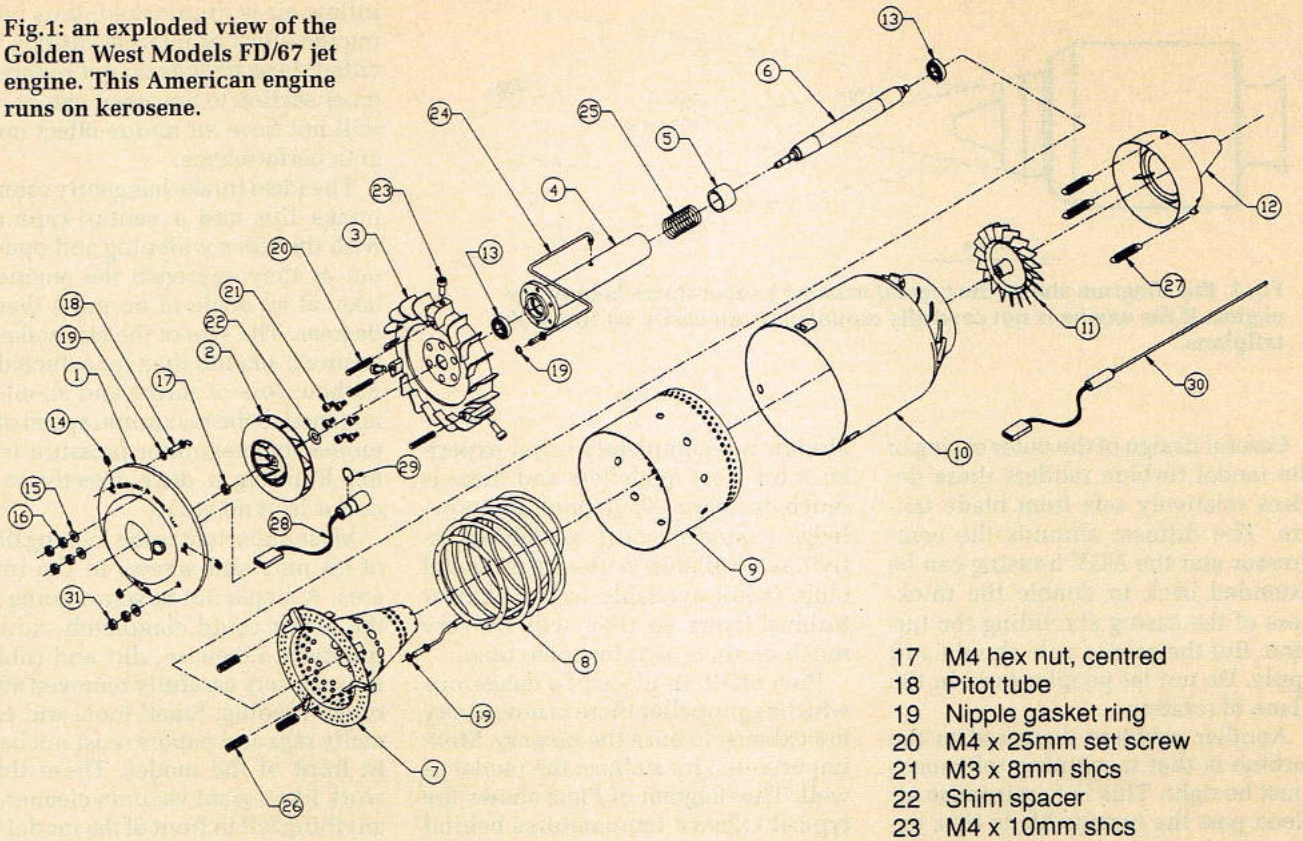


This is the turbine end of the shaft in Ken Jack's motor. Note that the blades have been profiled in a definite aerodynamic shape.

Turbine stage

Now to get back to the subject under discussion, last month we looked at the combustion chamber of the model jet engine. Following the combustion chamber is the turbine stage. This works in exactly the opposite manner to the compressor. Its purpose is to extract work from the hot exhaust gas from the combustion chamber and reduce it to rotational

Fig.1: an exploded view of the Golden West Models FD/67 jet engine. This American engine runs on kerosene.



1 Front cover
2 Compressor
3 Diffuser
4 Shaft support
5 Bearing bushing
6 Shaft
7 Inner combustion chamber
8 Fuel vaporiser
9 Outer combustion chamber
10 Outer housing
11 Turbine wheel
12 Exhaust nozzle
13 Ball bearings (steel)
14 Heavy-duty E-ring
15 M4 flat washer
16 M4 hex nut
17 M4 hex nut, centred
18 Pitot tube
19 Nipple gasket ring
20 M4 x 25mm set screw
21 M3 x 8mm shcs
22 Shim spacer
23 M4 x 10mm shcs
24 Oil feed tube assembly
25 Bearing preload spring
26 Combustion chamber spring
27 Exhaust nozzle spring
28 Tachometer assembly
29 Ext. retaining spring
30 EGT sensor assembly
31 M4 Nylock nut

kinetic energy. This rotational kinetic energy is then transferred via the shaft to the compressor.

The turbine stage consists of fixed nozzle guide vanes (NGV) and a rotor. The gases from the combustion chamber flow through the turbine's NGVs where the blade ducts act like small jets, accelerating the gases in the direction of turbine rotation. At the same time, the gases expand. As pressure and temperature fall, the speed rises rapidly, reaching about 1620km/h, even in model engines.

Once again we encounter these phenomenal operating conditions, all of which have served to place the model turbine outside the realms of possibility until recent times.

The photo of Ken Jack's jet engine shows quite clearly the complex shape of the connecting shaft between the turbine and compressor. This shaft is subject to severe dynamic bending stresses as it approaches critical rotational speed. If there is even a minute imbalance in the system, then as the rotational frequency approaches the resonant frequency of the shaft, oscillations may set in and the shaft may be completely destroyed or at the very least, bent permanently out of shape.

Worse still, the turbine blades may come into contact with the outer casing, with severe damage the certain result.

What must be borne in mind at all times when dealing with a jet turbine is that it spins at about 120,000 rpm while subject to very high temperatures. Any imbalance, casting or machining flaws can lead to a catastrophic failure which could result in a blade penetrating the outer casing and causing injury to bystanders.

For this reason, the golden rule of rotating engines applies with a vengeance. Do not stand in line with the propeller or any rotating parts, which in this case are the compressor and turbine.

And while we are on this subject, this is one of the nice things about operating model jets. There is no whirling propeller to stick your hand into; a very common cause of injury to model flyers. One very prominent modeller recently lost his thumb in a ducted fan, so even these propulsive units are not without their dangers. Care is the order of the day in all modelling activities, especially when dealing with high-powered motors of any kind.

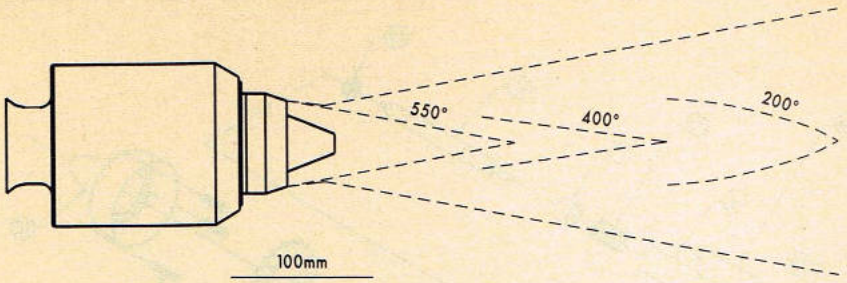


Fig.2. this diagram shows the typical exhaust temperatures behind the engine. If the engine is not carefully mounted it can easily set fire to the tailplane.

Careful design of the outer casing of the model turbine renders these devices relatively safe from blade failure. The diffuser shrouds the compressor and the NGV housing can be extended back to double the thickness of the casing shrouding the turbine. But the golden rule should still apply. Do not let people stand in the plane of rotation.

Another problem in regard to the turbine is that machining tolerances must be tight. This is to minimise air bleed past the turbine blade tips; excess air bleed greatly reduces the efficiency of the turbine. When you consider the temperature, rpm, metal creep and expansion, combined with the bending and flexing of the main shaft, this becomes a major compromise.

Once the gases have left the turbine, they are relatively free of swirl and with little energy left to convert into thrust. For this reason the design of the tail cone is extremely important in a model engine. The correct design can result in an increase in thrust of 15-20%, a worthwhile improvement to chase after.

So there is much to look forward to in the development of the model turbine. Thrust will go up, fuel consumption will go down, the size and weight of the engines will be reduced, and their reliability increased. Yet over all this development hangs the spectre of a model axial flow engine making its appearance. This will indeed revolutionise the fitting of turbines into slender airframes with the consequent increase in flying speeds. One wonders where it will all end. We certainly do live in exciting times.

Operating a gas turbine

Fitting a gas turbine into a model aircraft is a completely novel experience for most modellers and there is much to learn. That pool of knowledge regarding most modelling activities, available at the local model club, is not available to the pioneer turbine flyers so they will be very much on their own for some time.

First of all, in place of a dangerous whirling propeller there is now a very hot exhaust to burn the unwary. More importantly, it can burn the model as well. The diagram of Fig.2 shows the typical exhaust temperatures behind the engine.

Fortunately, there are simple fixes for these problems. The most simple is to mount the motor outside the fuselage, as on the A-10 Warthog shown in the January 1998 issue of SILICON CHIP. This is the recommended installation for your first jet-powered model.

This type of installation places no demands on your knowledge of intake and tailpipe aerodynamics and provides easy access to the engine for servicing and adjustment. And it presents the least fire hazard during starting.

Burying the engine inside the fuselage introduces a myriad of problems and is best undertaken after you have made yourself comfortable with the vast differences between operating a jet engine against a normal motor or ducted fan.

Once the engine is buried inside the fuselage, internal aerodynamics become almost as important as the external aerodynamics. To begin with, the air intake should act as a diffuser, slowing the incoming air and increasing the pressure in front of the compressor. This establishes a dynamic pressure in the model fuselage which varies with the square of the model's speed.

At the same time, the energy of the inflow air is diminished, thus reducing the effect of internal fittings. Provided these fittings do not reduce the cross section to any great extent, they will not have an undue effect on engine performance.

The ideal intake has gently rounded intake lips and a venturi-type duct with the sides widening and opening out as they approach the engine intake, at an angle of no more than 10 degrees. The size of the air intake can be much smaller than for a ducted fan without loss of thrust and should be matched to the maximum speed of the model for maximum pressure transfer. Running a duct directly to the motor is of no value.

Most important is the locking down of all nuts and screws in the intake area. A single nut or screw going into the motor could completely ruin the internals. Likewise, dirt and rubbish must be very carefully removed after a rough landing. Small tools and especially rags and papers must not be left in front of the model. These things work like a giant vacuum cleaner and anything left in front of the model will immediately fly into the compressor, so you have been warned.

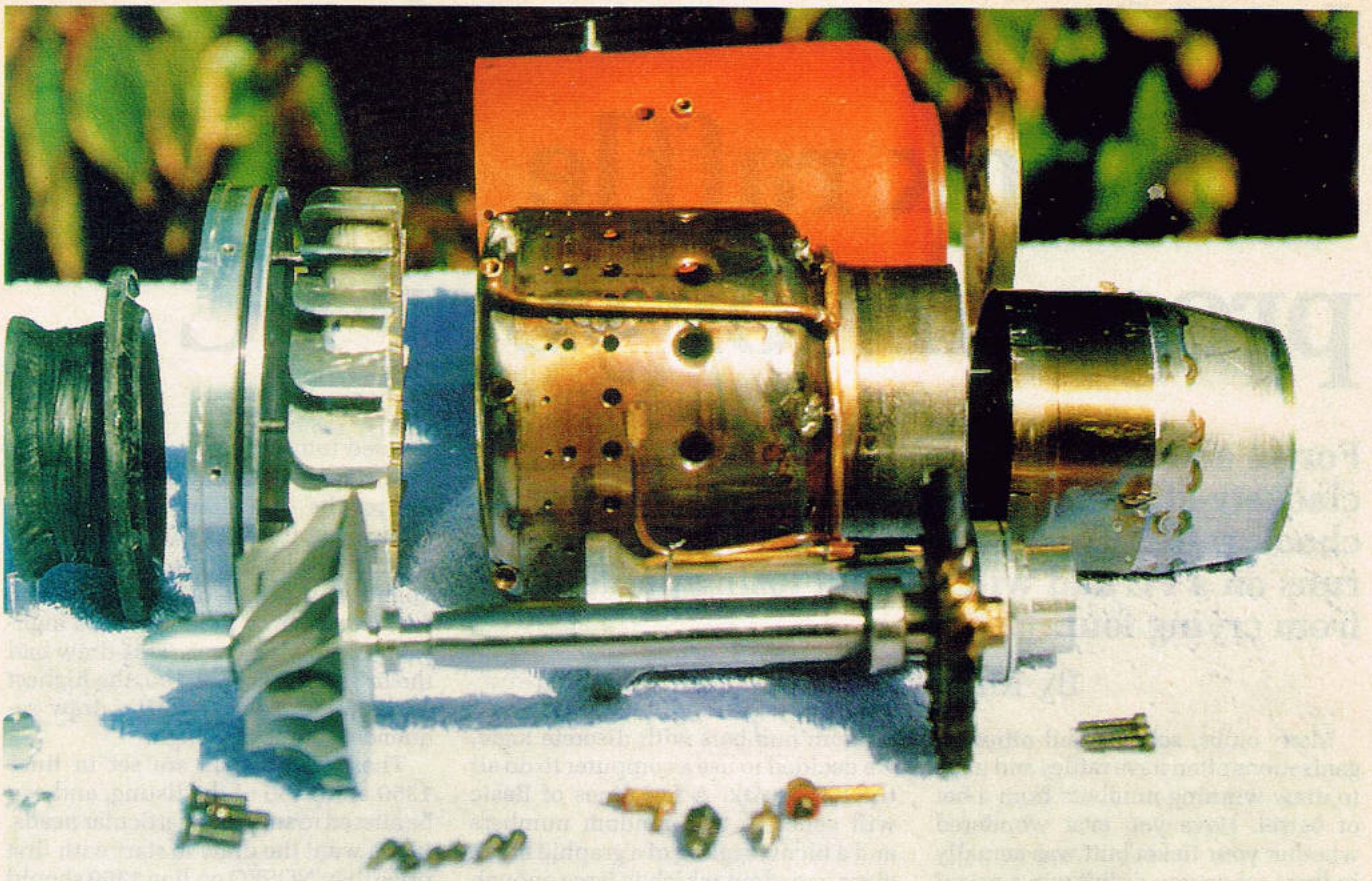
Cooling the fuselage

The engine itself presents few problems as it stays relatively cool. The compressor area runs at around 120°C and up to about 200°C at the rear end. The only parts which become extremely hot are the turbine enclosure, mounting flange and the exhaust cone.

The greatest problem is ducting the exhaust gas out of the tailpipe whilst minimising the duct losses. A thrust pipe which acts as an injector is the best solution here. This type of duct draws in cooling air and increases the total throughput of gases, thereby increasing thrust as well as cooling and protecting the tailpipe. The increased throughput must be calculated into the air intake which will need a correspondingly larger cross-sectional area.

As I said before, having the engine out in the open places no demands upon your knowledge of duct aerodynamics. It's not as pretty to be sure, but is a lot easier for your first model.

Balsawood is very susceptible to hot exhaust gases as the wood contains plenty of oxygen. An imperceptible glow is quickly fanned into life when you open the throttle and it



This is a very exciting development in the use of jet-powered models: an Australian designed engine developed by Ken Jack. In the foreground is the shaft with turbine and compressor fitted. Immediately behind is the inlet, diffuser combustion chamber, nozzle guide vanes (NGV) and tail cone. In the background is the outer housing.

spreads over the wood in long snaking lines. A few seconds at full throttle can be enough to have the tailplane engulfed in flames.

Aluminium foil glued on with thinned white glue provides a good protective barrier against the less severe gases while thin aluminium sheet (0.3mm) can be reserved for the hotter areas. You can refer to the diagram of Fig.2 for a guide to the temperatures at various distances from the tail cone of the motor.

Starting the gas turbine

Starting a fully enclosed motor presents additional problems. The starting fan may not provide sufficient air to cool the ducting as well as start the motor. Flames coming out of the motor before it settles into normal operating revs and temperature can very quickly raise the tailpipe ducts to red heat. Thus, two of the requisite items for jet starting operations are a very strong fan or air source (compressed air bottles) and a fire extinguisher.

As soon as the engine is running, turbulence causes cooling air to be mixed into the exhaust stream and half a metre downstream the temperature is low enough that it will not burn plywood. The hot core of the exhaust stream extends to a point approximately three times the diameter of the tail cone.

I should make one more point while on the subject of hot exhaust gases: they can start grass fires. The strips used for jet operation often feature long brown strips of dead grass, so watch out.

Ancillary equipment

Unlike its piston-powered equivalent, the model gas turbine is not a self-contained unit. There are several support items which need to be mounted in the model for the unit to operate satisfactorily. Of these, the two most important are the fuel pump and oil reservoir. Most model turbines use a total-loss oil system where oil is either placed under pressure or pumped into the bearing shaft and the oil circulates through the bearings and out of the engine. Typical oil consumption can be as high as 5ml a minute but is usually lower on most motors.

On early experimental jets the throttle drove the fuel pump and the supply of fuel determined the engine rpm. However, this is not very satisfactory and more sophisticated commercial engines such as the Golden West FD/67 use an engine control unit (ECU) which monitors exhaust gas temperature and RPM. The throttle channel is hooked directly into the ECU and special software algorithms compute the acceleration requirements of the turbine.

The ECU then drives the fuel pump and monitors the safety aspects of the engine. If any parameters move outside the safe zone the engine is automatically shut down. The ECU is mounted in the aircraft.

By now the reader should be aware of the high level of technology inside a gas turbine model and the precautions necessary to operate it. **SC**

A chook raffle program for your PC

Forget about hats, barrels and old-fashioned clackety-clack chocolate wheels for your next chook raffle. This random number generator runs on a PC and will prevent losing punters from crying foul.

By RICK WALTERS

Many clubs, schools and other organisations often have raffles and need to draw winning numbers from a hat or barrel. Have you ever wondered whether your ticket butt was actually in there when you didn't win a prize? This random number generator program guarantees that everyone has an equal chance to win the chook.

By selecting the appropriate range of numbers, the program can also be used to select numbers for Lotto.

Design

After looking at the cost of the components necessary to make a display and the difficulty in generating true random numbers with discrete logic, we decided to use a computer to do all the hard work. A few lines of Basic will generate true random numbers and a bit of juggling of a graphic block gives a readout which is large enough to be seen quite a distance from the computer screen. Additionally, the results of each draw are saved to the hard disc and can be recalled and displayed if necessary.

The program, RAFFLE.BAS (see listing on pages 75-76), requires an EGA monitor and video card capable of 640 x 480 pixel display. This means that you may have an old 286 or newer system lying around which can be pressed into service.

The screen display of Fig.1 shows the results of a draw. The program allows you to select the lowest draw number, the highest draw number, the quantity of prizes to be drawn, and whether to draw from lowest to highest prize or vice versa. This draw had the lowest number as 100, the highest as 5000, 10 prizes and the draw sequence from low to high.

These parameters are set in lines 1350 and 1360 of the listing, and can be altered to suit your particular needs. If you want the draw to start with first prize then NOSEQ on line 1360 should be changed to equal 1.

Lines 20-50 control the program sequence, with line 20 calling the initialisation routine. This includes the starting and finishing numbers and also defines a host of parameters that will be used. The SC logo and header, along with the results box ,is drawn by subroutine 5000.

The real work is done in subroutine 2000, where the random number is actually generated. If the RND (generate a random number) function was used, each time the program was run it would generate the same series of numbers. To prevent this happening, line 2030 uses the RANDOMIZE (sorry about the US spelling) function.

This by itself will prompt you for an input. However, the last thing we want in this type of program is for it to ask the unsuspecting user for input. By adding TIMER, we force Basic to read the DOS clock and use this number as its input. As the timer value increments each second, this will always have a different value and produce a different sequence of numbers.

The number generated will always be between zero and one, so to make it fit our requirements we have to introduce the number to start (NOTO-

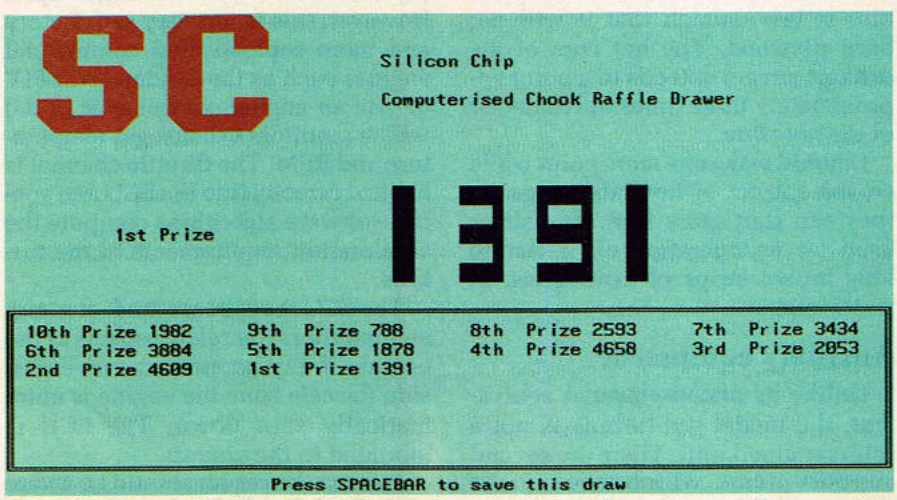


Fig.1:this screen display shows the results of a draw. The program allows you to select the lowest draw number, the highest draw number, the quantity of prizes to be drawn, and whether to draw from lowest to highest prize or vice versa

Listing 1: Raffle.bas

```
1 GOTO 10
5 SAVE "C:\bas\raffle",A 'Save file on C drive in ASCII format
6 SAVE "A:\bas\raffle",A 'Save file on A drive
7 SAVE "B:\bas\raffle",A 'Save file on B drive
10 REM This program draws a raffle & shows the result
11 'in large numerals in the top area of the screen
12 'When the next prize is drawn the previous draw
13 'is recorded in the lower area of the screen
14 'Lowest & highest number & number of prizes to draw
15 'as well as draw from high to low or low to high
16 'can be selected.
17 REM run 5 will save program to drive C
18 REM run 6 will save program to drive A
19 REM run 7 will save program to drive B
20 GOSUB 1000 'Initialise
30 GOSUB 5000 'Write heading
40 GOSUB 2000 'Generate a random number
50 GOSUB 6000 'Save draw to hard disk
999 CLS: SYSTEM
1000 '************************
1010 'Initialisation routine.
1020 '************************
1030 KEY OFF: SCREEN 9: CLS: DEFINT A-C,R,N: DEFSTR D,E,K,U
1035 'A to C,R & N integers, D,E,K,U Are strings, rest single
  precision
1040 ESC = CHR$(27): ENTER = CHR$(13): KSP = CHR$(32)
  'Spacebar
1140 DEF FNCENTRE$(M$) = SPACE$((79 - LEN(M$))/2) + M$
  'Centre text
1150 DEF FNCEOL$ = STRING$(79 - POS(Q)," ")
1170 ULT = CHR$(218): DLT = CHR$(201): URT = CHR$(191): DRT =
  CHR$(187)
1175 'Single & Double Left & Right top corners
1180 ULB = CHR$(192): DLB = CHR$(200): URB = CHR$(217): DRB
  = CHR$(188)
1185 'Single & Double Left & Right bottom corners
1190 UH = CHR$(196): DH = CHR$(205): UV = CHR$(179): DV =
  CHR$(186)
1195 'Single & Double Horizontal & vertical lines
1350 NOTOSTART = 100: NOTOFIN = 5000
1360 NOTODRAW = 10: NOSEQ = 0 'Low to Hi, 1 = Hi to low
1370 DIM DRAWN$(NOTODRAW)
1380 RL = 10: CL = 35: C1 = 10 'Row & column for large digits
1390 RP = 17: CP = 3 'Row & column for prize listings
1400 RR = RP 'Row reference for view print in sub 7000
1410 DOB = CHR$(219) '8 x 14 block
1420 SLOW = 3000 'Delay for poker machine routine. Smaller for
  slow machines
1999 RETURN
2000 '************************
2010 'Generate a random number.
2020 '************************
2030 RANDOMIZE TIMER
2040 LOCATE 25,1: PRINT FNCENTRE$("Press SPACEBAR for First
  draw");
2050 K = INPUT$(1): IF K < > KSP THEN 2050
2060 FOR A = 1 TO NOTODRAW
2070 X = INT(RND * (NOTOFIN - NOTOSTART)) + NOTOSTART
  'Generate a number
2080 FOR B = 1 TO A 'Check to see if this is the same as the first
  number drawn
2090 IF VAL(DRAWN$(B)) = X THEN 2070 'if so generate a new
  number
2100 NEXT B 'otherwise check the rest
2110 DRAWN$(A) = STR$(X) 'If not previously drawn add it to the
  list
2120 LOCATE 25,1: PRINT FNCEOL$;
2130 GOSUB 3000 'Do poker machine style draw
2140 GOSUB 7000 'Move number to display area
2150 IF A = NOTODRAW THEN 2190 'All numbers drawn
2160 LOCATE 25,1: PRINT FNCENTRE$("Press SPACEBAR for next
  draw");
2170 K = INPUT$(1): IF K < > KSP THEN 2170
2180 NEXT A 'Then generate the next number
2190 LOCATE 25,1: PRINT FNCENTRE$("Press SPACEBAR to save
  this draw");
2200 K = INPUT$(1): IF K < > KSP THEN 2200
2999 RETURN
3000 '************************
3010 'Poker machine style draw.
3020 '************************
3030 R = RL: C = CL 'Restore original row & column values
3040 FOR B = 2 TO LEN(DRAWN$(A))
3050 LOCATE R + 2,10: IF NOSEQ THEN PRINT A; ELSE PRINT
  NOTODRAW + 1 - A;
3060 LOCATE R+2,POS(X)-1
3070 IF NOSEQ THEN IF A = 1 THEN PRINT "st"; ELSE IF A = 2 THEN
  PRINT "nd";
3080 IF NOSEQ THEN IF A = 3 THEN PRINT "rd"; ELSE IF A > 3 THEN
  PRINT "th";
3090 IF NOSEQ = 0 THEN IF A = NOTODRAW THEN PRINT "st"; ELSE
  IF A = NOTODRAW-1 THEN PRINT "nd";
3100 IF NOSEQ = 0 THEN IF A = NOTODRAW-2 THEN PRINT "rd";
  ELSE IF A < NOTODRAW-2 THEN PRINT "th";
3110 PRINT " Prize ";
3120 GOSUB 4030: GOSUB 3330 'Print a 0
3130 GOSUB 4130: GOSUB 3330 'Print a 1
3140 GOSUB 4230: GOSUB 3330 'Print a 2
3150 GOSUB 4330: GOSUB 3330 'Print a 3
3160 GOSUB 4430: GOSUB 3330 'Print a 4
3170 GOSUB 4530: GOSUB 3330 'Print a 5
3180 GOSUB 4630: GOSUB 3330 'Print a 6
3190 GOSUB 4730: GOSUB 3330 'Print a 7
3200 GOSUB 4830: GOSUB 3330 'Print an 8
3210 GOSUB 4930: GOSUB 3330 'Print a 9, then print first digit of
  random number
3220 CC = VAL(MID$(DRAWN$(A),B,1))
3230 ON CC + 1 GOSUB
  4030,4130,4230,4330,4430,4530,4630,4730,4830,4930
3240 C = C + 7 'Add a space between digits
3250 NEXT 'Then print the next digit
3299 RETURN 'Go back to SUB 2000 at line 2140
3300 '************************************************
3310 'Delay routine to allow numbers to appear slowly.
3320 '************************************************
3330 FOR AA = 1 TO SLOW: NEXT: FOR AA = 1 TO SLOW: NEXT
3340 FOR BB = 0 TO 4: LOCATE R + BB,C: PRINT STRING$(7," ")
3350 NEXT BB
3399 RETURN
4000
  '*****************************************************************
4010 '4030 - 4920 draw large block digits from 0 to 9 at the
  location R,C.
4020
  '*****************************************************************
```

continued on page 76

Listing 1: Raffle.bas

continued from page 75

```
4030 'digit 0
4040 LOCATE R,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT
4050 FOR AA = 1 TO 4: LOCATE CSRLIN,C: PRINT DOB;: LOCATE
   CSRLIN,C+4: PRINT DOB: NEXT
4060 LOCATE CSRLIN,C: FOR AA = 1 TO 5: PRINT DOB;: NEXT
4099 RETURN
4120 'digit 1
4130 LOCATE R,C+1: PRINT DOB;DOB
4140 FOR AA = 1 TO 3: LOCATE CSRLIN,C+1: PRINT DOB;DOB:
   NEXT
4150 LOCATE CSRLIN,C + 1: PRINT DOB;DOB;
4199 RETURN
4220 'digit 2
4230 LOCATE R,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT: PRINT
4240 LOCATE CSRLIN,C+3: PRINT DOB
4250 LOCATE CSRLIN,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT:
   PRINT
4260 LOCATE CSRLIN,C: PRINT DOB
4270 LOCATE CSRLIN,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT
4299 RETURN
4320 'digit 3
4330 LOCATE R,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT: PRINT
4340 LOCATE CSRLIN,C+3: PRINT DOB
4350 LOCATE CSRLIN,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT:
   PRINT
4360 LOCATE CSRLIN,C+3: PRINT DOB
4370 LOCATE CSRLIN,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT
4399 RETURN
4420 'digit 4
4430 LOCATE R,C: PRINT DOB;DOB: LOCATE CSRLIN,C: PRINT
   DOB;DOB
4440 LOCATE CSRLIN,C: PRINT DOB;DOB;SPC(2);DOB
4450 LOCATE CSRLIN,C: FOR AA = 1 TO 6: PRINT DOB;: NEXT:
   PRINT
4460 LOCATE CSRLIN,C+4: PRINT DOB;
4499 RETURN
4520 'digit 5
4530 LOCATE R,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT: PRINT
4540 LOCATE CSRLIN,C: PRINT DOB
4550 LOCATE CSRLIN,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT:
   PRINT
4560 LOCATE CSRLIN,C+3: PRINT DOB
4570 LOCATE CSRLIN,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT
4599 RETURN
4620 'digit 6
4630 LOCATE R,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT: PRINT
4640 LOCATE CSRLIN,C: PRINT DOB
4650 LOCATE CSRLIN,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT:
   PRINT
4660 LOCATE CSRLIN,C: PRINT DOB; SPC(2);DOB
4670 LOCATE CSRLIN,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT
4699 RETURN
4720 'digit 7
4730 LOCATE R,C: FOR AA = 1 TO 5: PRINT DOB;: NEXT: PRINT
4740 FOR AA = 1 TO 3: LOCATE CSRLIN,C+3: PRINT DOB;DOB:
   NEXT
4780 LOCATE CSRLIN,C+3: PRINT DOB;DOB;
4799 RETURN
4820 'digit 8
4830 LOCATE R,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT
4840 FOR AA = 1 TO 2: LOCATE CSRLIN,C: PRINT DOB;: LOCATE
   CSRLIN,C+4: PRINT DOB: NEXT
4850 LOCATE CSRLIN,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT
4860 FOR AA = 1 TO 2: LOCATE CSRLIN,C: PRINT DOB;: LOCATE
   CSRLIN,C+4: PRINT DOB: NEXT
4870 LOCATE CSRLIN,C: FOR AA = 1 TO 5: PRINT DOB;: NEXT
4899 RETURN
4920 'digit 9
4930 LOCATE R,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT
4940 FOR AA = 1 TO 2: LOCATE CSRLIN,C: PRINT DOB;: LOCATE
   CSRLIN,C+4: PRINT DOB: NEXT
4950 LOCATE CSRLIN,C: FOR AA = 1 TO 4: PRINT DOB;: NEXT
4960 FOR AA = 1 TO 2: LOCATE CSRLIN,C+4: PRINT DOB: NEXT
4970 LOCATE CSRLIN,C: FOR AA = 1 TO 5: PRINT DOB;: NEXT
4999 RETURN
5000 '*****************
5010 'Write to screen.
5020 '*****************
5030 COLOR 4,11: X = 100: Y = 25: PSET (X,Y) 'Write SC to
   screen
5040 DRAW
   "u12;h12;l48;g12;d24;f12;r32;d24;l24;u12;l24;d12;f12;r48"
5050 PSET (X,Y): DRAW "l24;u12;l24;d24;r32;f12;d24;g12"
5060 PAINT (X-20,Y-5) 'draw & fill S
5070 PSET (X+90,Y)
5080 DRAW
   "u12;h12;l48;g12;d60;f12;r48;e12;u12;l24;d12;l24;u60;r24;d12;r24"
5090 PAINT (X+80,Y-5) 'draw & fill C
5100 COLOR 14,11
5110 LOCATE 3,35: PRINT "Silicon Chip";
5120 LOCATE 5,35: PRINT "Computerised Chook Raffle
   Drawer";
5130 LOCATE 16,1: PRINT DLT;
5140 FOR J = 2 TO 79: PRINT DH;: NEXT: PRINT DRT;
5150 FOR J = 2 TO 8: PRINT DV;TAB(80);DV;: NEXT
5160 PRINT DLB;: FOR J = 2 TO 79: PRINT DH;: NEXT: PRINT
   DRB;
5199 RETURN
6000 '*******************
6010 'Save draw to disk.
6020 '*******************
6030 D$ = MID$(DATE$,4,2) + LEFT$(DATE$,2) 'Date
6040 T$ = LEFT$(TIME$,2) + MID$(TIME$,4,2) 'Time
6050 FILE$ = D$ + T$ + ".DRW" 'Name file as date + time & add
   filetype
6060 OPEN FILE$ FOR OUTPUT AS #1
6070 WRITE# 1, NOSEQ 'Write Hi to low or low to high
   sequence
6080 FOR A = 1 TO NOTODRAW
6090 WRITE# 1, DRAWN$(A) 'Save the numbers
6100 NEXT A
6110 CLOSE 1
6999 RETURN
7000 '************************************
7010 'Write draw & number to display area.
7020 '************************************
7030 PRIZE$ = ""
7040 FOR CS = 1 TO 4: PRIZE$ = PRIZE$ +
   CHR$(SCREEN(R+2,CS+10)): NEXT
7050 VIEW PRINT RR TO 23
7060 LOCATE RP,CP: PRINT PRIZE$;" Prize";X; 'Space results by
   20 then goto next
7070 CP = CP + 20: IF CP > 65 THEN CP = 3: RP = RP + 1 'line
   after four entries
7080 VIEW PRINT
7999 RETURN 'Go back to SUB 2000 at line 2150
```

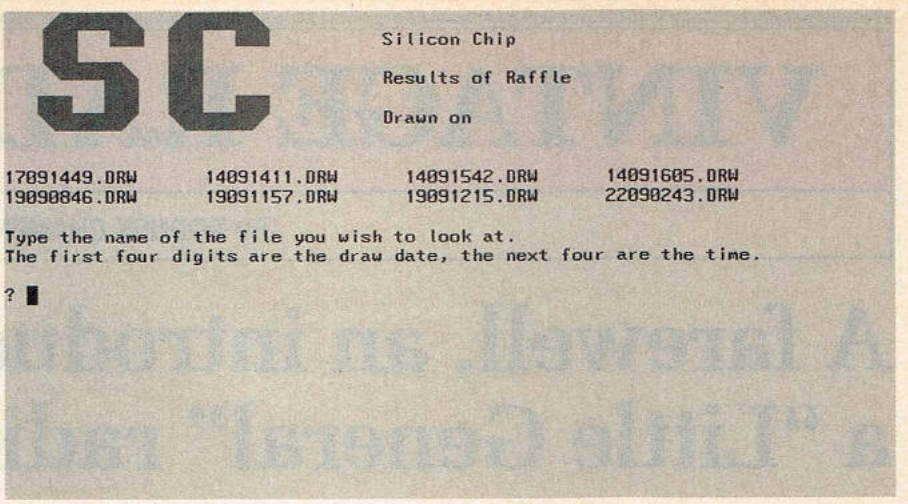
START) and the number to finish (NOTOFIN) into the result. This is done on line 2070. Once we have a value, we must make sure that it hasn't been drawn already and this is done in lines 2080-2100. If this is the case, then we store it with all the previously drawn results in a array called DRAWN$ on line 2110.

We now go to subroutine 3000 where the prize number is printed, followed by the prize suffix (st, th, etc). Line 3060 moves the cursor back one space as Basic puts a space after an integer before printing a string and "1 st" doesn't look quite right. The next four lines (3070- 3100) work out which direction the sequence runs and print the appropriate suffix.

Now comes the actual number for the draw. To add to the suspense, we print the large digits from 0-9 in sequence before actually displaying the correct digit. They should appear rather slowly and depending upon the computer you use you may have to reduce the value in line 1420, or even delete the second FOR AA = 1 TO SLOW: NEXT on line 3330.

After we print the large digits we move to subroutine 7000 which records the prize sequence and draw number in the rectangular box. We cheat a bit here, to save us going through the prize number and suffix rigmarole again, by using the SCREEN(R,C) function to look at what we actually wrote previously and building a string called PRIZE$ in line 7040. This is then written in the box along with the draw number.

Once the NOTODRAW (number to draw) has been written to the box, a message appears on line 25 indicating that this is the case and prompting you to press the space-bar to save the draw to disc. This is done in subroutine 6000 where the filename is created as the date plus the time with a DRW suffix; ie 17091445.DRW. The draw sequence as well as all the results are saved, to allow unambiguous recovery of the draw.


SC
Silicon Chip
Results of Raffle
Drawn on
17091449.DRW 14091411.DRW 14091542.DRW 14091605.DRW
19090846.DRW 19091157.DRW 19091215.DRW 22090243.DRW
Type the name of the file you wish to look at.
The first four digits are the draw date, the next four are the time.
?

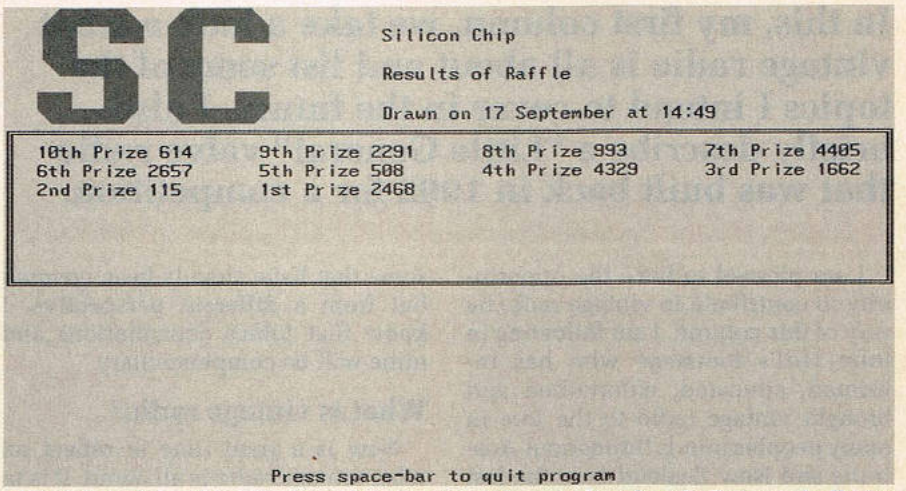

SC
Silicon Chip
Results of Raffle
Drawn on 17 September at 14:49
10th Prize 614 9th Prize 2291 8th Prize 993 7th Prize 4405
6th Prize 2657 5th Prize 508 4th Prize 4329 3rd Prize 1662
2nd Prize 115 1st Prize 2468
Press space-bar to quit program

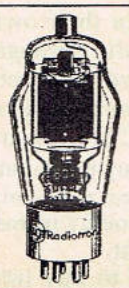
Fig.2 (top): the software automatically saves the results of each draw and allows you to view the results of previous draws at any time by typing in the file name. Fig.3 (above) shows how the results of previous draws are displayed.

Previous draws

Fig.2 shows the screen for selecting the results of a previous draw. All the raffle files are listed and when a filename which appears on the screen is entered the results will be displayed as shown in Fig.3.

No print-out routine is included as the Print Screen function can be used if a hard copy is needed.

The DRW suffix is not needed when you enter a filename but if an incorrect filename is entered, the cursor will move back to the beginning of the name, thereby allowing you to see and correct your error. This draw listing (PRIZELST.BAS) is not included here due to space limitations but is available along with the complete Raffle software on a floppy disc from SILICON CHIP (see software advert).



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VINTAGE RADIO

By RODNEY CHAMPNESS, VK3UG

A farewell, an introduction & a "Little General" radio set

In this, my first column, we take a look a what vintage radio is all about and list some of the topics I intend to cover in the future. I also briefly describe a "Little General" valve radio that was built back in 1992 for a competition.

I am pleased to have the opportunity to contribute to vintage radio by way of this column. I am following in John Hill's footsteps who has informed, educated, entertained and brought vintage radio to the fore in many peoples minds throughout Australia and New Zealand over the last decade. Some readers have not agreed with his thoughts in particular areas but this has produced a positive result because it has made people consider what vintage radio is all about.

I will endeavour to continue to attract readers' interest in vintage radio in its many aspects, covering topics not previously mentioned as well as some that have already been covered but from a different perspective. I know that John's contributions and mine will be complementary.

What is vintage radio?

Now is a good time to reflect on what vintage radio is all about. It is to do with the collection, retention, restoration and display of our radio (and, dare I say it, television) heritage. Some people are interested in collecting and preserving magazines, service manuals, books and advertising material dealing with our radio history. Others collect 1920's sets or sets from whatever era they particularly fancy.

Many will just keep the sets as they are while others will fully restore them to their former glory. The collection of technically innovative sets or unusual sets will appeal to others, while some prefer to restore sets where their ability at fine woodworking can really come to the fore.

A small but growing group is interested in building replicas of a bygone era and learning about how the sets worked. Others will build a "bitser" out of several sets to show others what a typical set of the particular type was like. To me, all of these activities are valid as long as people don't claim something to be what it isn't. For example, converting a battery set to AC, then claiming that this is how this particular "AC" set works is quite wrong in my book.

Many sets were converted from vibrator or battery operation when AC power came to country areas and I was one who converted several sets at the time. It was cheaper to convert to AC than throw them out and buy a new one. In general they were good sets and the heart transplant of AC valves made them even better performers, provided the conversion was done competently. This occurred before vintage radio collection and the retention of our radio heritage became of interest.

These converted sets in their own way fill a niche in our radio heritage. However, I don't believe that sets should be converted from battery or vibrator operation to AC if they are intact today. After all, they are a part of our radio heritage, are relatively rare and are definitely worthy of restoration in their own right.

It is not my intention to buy into

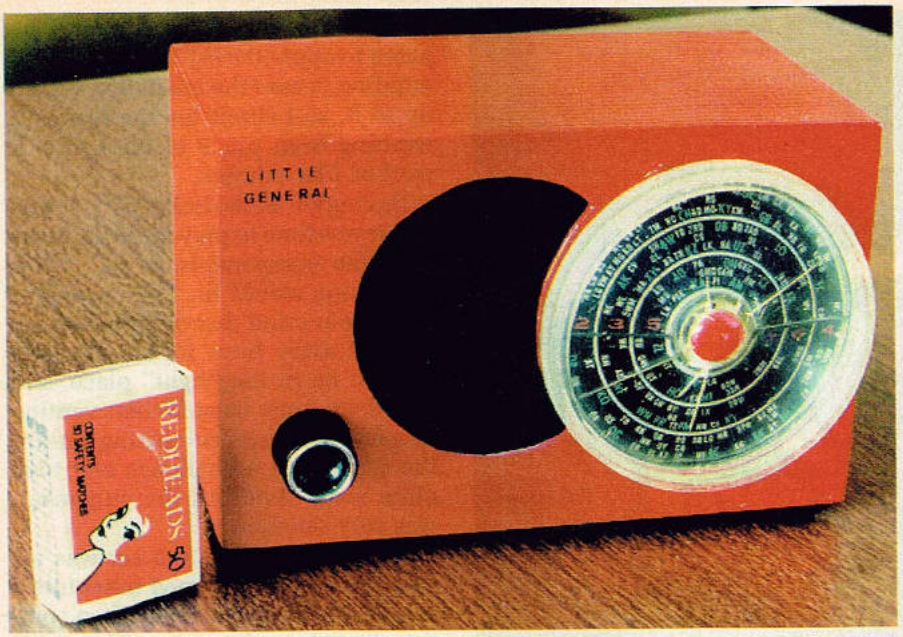
Farewell from John Hill

For 10 years I have been writing Vintage Radio for SILICON CHIP magazine. However, after 120 editions I have exhausted my storehouse of ideas and have nothing left to write about.

Past material could be rehashed, but that has already been done in some instances. It is better for me to sign off and let someone else with some fresh material have a go and that someone is Rodney Champness. A change in direction should be good for both the magazine and its readers.

I wish Rodney well in his new venture and hope he enjoys it as much as I did. I would also like to take this opportunity to thank Greg Swain, Leo Simpson and Philip Watson for their assistance over the past 10 years.

John Hill.



The author's "Little General" is quite compact for a radio receiver that's based on valves.

arguments about what an individual should or should not do with his or her sets. However, I believe our endeavour should be to retain as accurate a record of our radio/wireless heritage as possible.

People who are genuinely interested in vintage radio come from many walks of life. Some like myself have been professionally involved in radio all their adult lives, while others have only recently had the spark of interest kindled in vintage radio. Particular interests in vintage radio can be quite varied and I will endeavour to cover as many topics as I believe I can competently handle.

Any constructive criticism is welcome as are suggestions on topics to cover. Comments from across the Tasman would be also most welcome, as I would like this column to continue to be relevant to New Zealand readers.

What will be covered?

I expect to present articles on sets of specific interest, history, test instruments, servicing/restoration, safety, design, transistor sets (yes, some are vintage sets now), vintage TV sets and other subjects as they come to mind or as readers suggest them.

I have had an interest in the transmitting side of radio as well as receiving, so there will also be material on this topic from time to time. This aspect of vintage radio is important because without transmitters there would be no need for receivers!

A "Little General"

The "Little General" was a radio designed by "Radio & Hobbies" magazine at the beginning of World War II. It was so successful that upgraded versions were presented up until the early 1960s.

As a concept, it was intended as an austerity set running off AC mains, with a converter, one IF stage, one audio stage (the last versions had 2-stage audio amplifiers) and a rectifier. It was not expected to be high fidelity or to be highly sensitive and was limited to one watt of audio. Instead, it was intended to be a good little second set for the workshop, garage or the kitchen that was easy to build and get going, at minimal cost.

The beauty of the design was that it could be built by obtaining the bits and pieces as required or by using substitute parts. It was also possible, at the time, to buy a complete kit and meticulously copy the layout and wiring diagrams shown in the magazine. Thousands of these sets were built from the various models described.

In 1991/92, the Vintage Radio Club of North East Victoria ran a competition to build a "Little General". I, along with about 12 others, joined in the fun, with some building near exact copies of particular models while others let their flair for design run riot. Some built sets with beautiful cabinets in the old cathedral style, while I decided to build the smallest one I could with really good performance. The accompanying circuit and photographs show what the set is like.

I took this as quite a challenge, and commenced looking up all the old circuits I could find that fitted the criteria of a "Little General". I remembered that a portable valve TV set I commonly worked on used a sharp cutoff video IF valve (6EW6) in the audio output. Why not, I thought; just because it is designed for RF doesn't mean it won't work well at audio frequencies. It wouldn't give as much output as a 6V6 but then I didn't want megawatts of sound anyway.

I went through the valve data book and narrowed the list of suitable valves down to just a few, then checked how much space there was in the proposed cabinet. Finally, a 6EJ7, a very high gain video IF valve, was selected. A 6BX6 would have worked nearly as well but was taller and wouldn't fit into the cabinet. Another advantage here was that the heater current was only 0.3 amps.

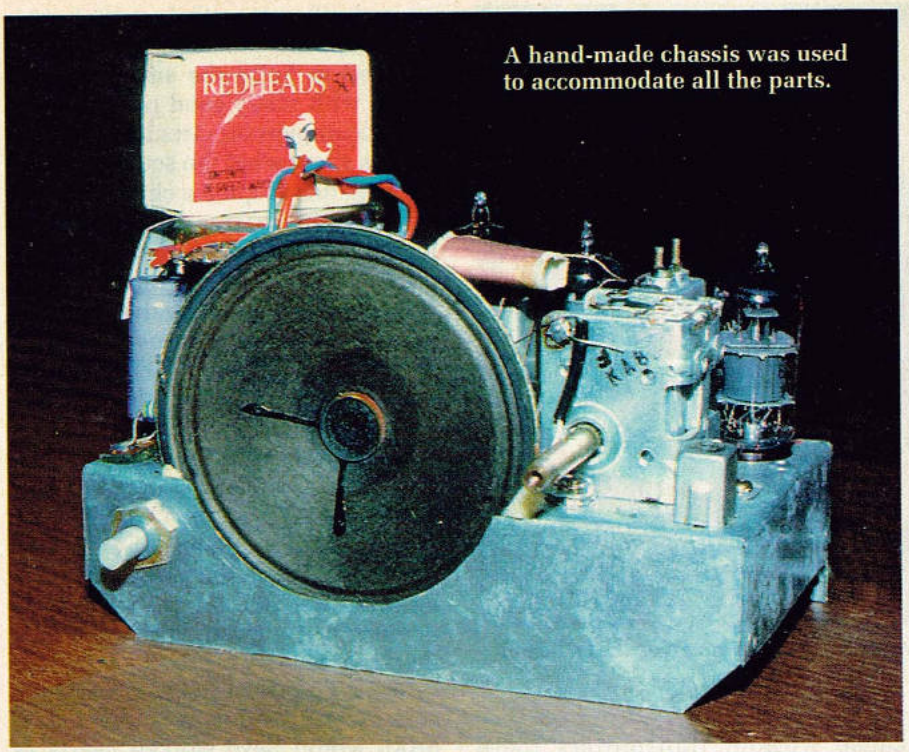
Next was a suitable IF valve. As AGC/AVC was to be supplied to this valve, one with variable cutoff was needed. A 6BA6 would have been quite suitable but I wanted to keep the heater current down. A very suitable valve, a 6BJ6, came to mind with its heater current of only 0.15 amps and so this was selected.

I couldn't find any converter valve in the common series that had a 0.15A heater, so after looking at all the available types, I decided that the 6AE8 was as good as any. Physically, it wasn't too high either. Therefore, the total heater drain was 0.75 amps and with a miniature dial lamp would total 0.8 amps – the heater current of a 6BV7 by itself!

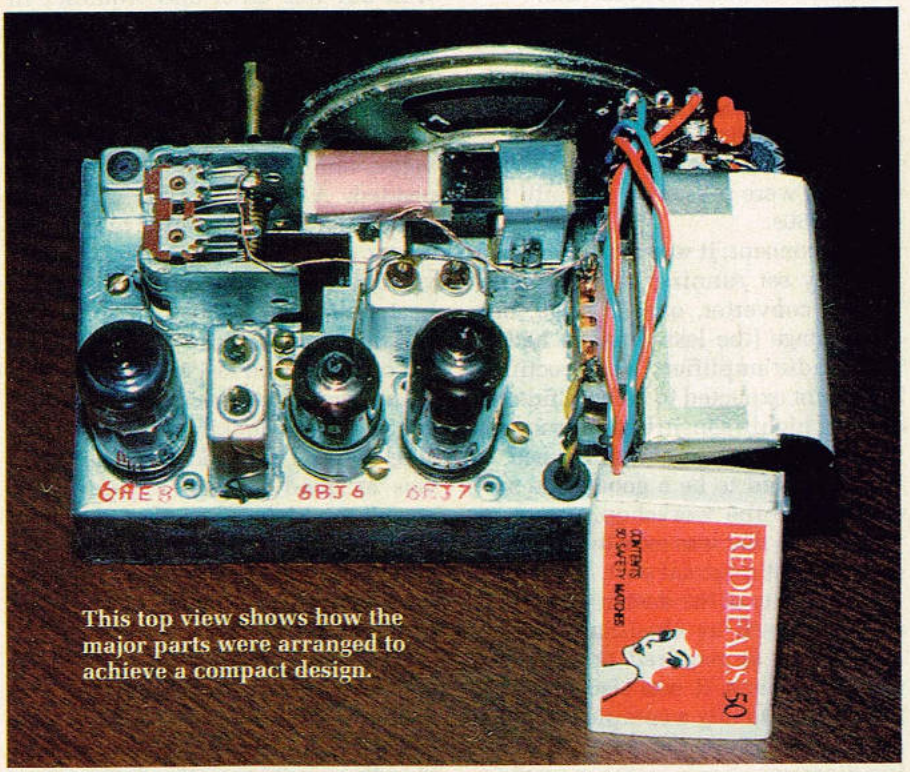
As none of these valves has in-built detector diodes, a decision was made to use silicon detector diodes – one acting to produce delayed AGC and the other working as the detector.

Power transformer

Power transformers can be a real problem and getting one that would supply the required voltages and current was a tad awkward. I was fortunate that one of the members of the club offered to rewind a 2155 transformer for me, for which I was grate-



A hand-made chassis was used to accommodate all the parts.



This top view shows how the major parts were arranged to achieve a compact design.

ful. The 6.3V winding was left intact and the new HT winding (wound with 37 B&S enamelled wire) gave about 115V AC which, when rectified by a bridge rectifier, gave 135V DC on load. This was a little less than was hoped for but adequate just the same.

I was fortunate in having a couple of the miniature Philips IF transformers, a miniature MSP padderless dual-gang tuning capacitor, a 3.5-inch loudspeaker, a ferrite rod and coil (sold as replacements for transistor sets) and the oscillator coil from a transistor radio.

It was doubtful how the transistor oscillator coil would go. I wasn't prepared to apply the HT to the feedback winding in case the insulation wasn't up to it, so I shunt fed the feedback winding from pin 9 of the 6AE8. It worked like a dream.

Having got all the bulky parts sorted out, it was time to play musical chairs with the components to see where everything would fit. This was done keeping in mind that outputs need to be kept away from inputs, controls need to be in the "right" place, and that there must be sufficient ventilation for all the heat-producing parts of the set. It was a challenge and took quite some time but the end result was very satisfying.

After much work, the set was assembled and shoehorned into quite a small case, as can be seen when compared to a box of matches. There was quite a bit of fine tuning of the circuitry to get the best out of the set. I was fortunate enough to be able to use an AVO mutual conductance valve tester to set the operating conditions of the valves to optimum.

There are a few items I found which may be of assistance to other constructors. It is desirable to put an earthed shield across the IF valve socket to shield the input from the output, particularly when using a high-gain valve. The set was a bit unstable until that was done.

The filtering of the IF signal out of the audio section is not well done in most sets and a small mica or ceramic capacitor from the grid of the audio output valve to earth (pin 2 to earth in this case) overcomes this problem. Most sets put the capacitor on the other side of the grid stopper resistor, where it is ineffective.

It is most desirable to keep iron-cored transformers mounted so that their cores are not in line with one another, otherwise hum can be induced from the power transformer into the audio transformer. I tried various tricks with the speaker transformer, but was unable to completely rid the set of hum due to this induction.

The final set is shown in the photographs and it really is quite compact. The set will detect 5 microvolt signals over its 525-1650kHz tuning range, has 0.4 watts of audio output, uses 0.8A at 6.3V and 25mV at 135V, and draws about 13 watts from the mains. It didn't win the competition but it did get second place. **SC**

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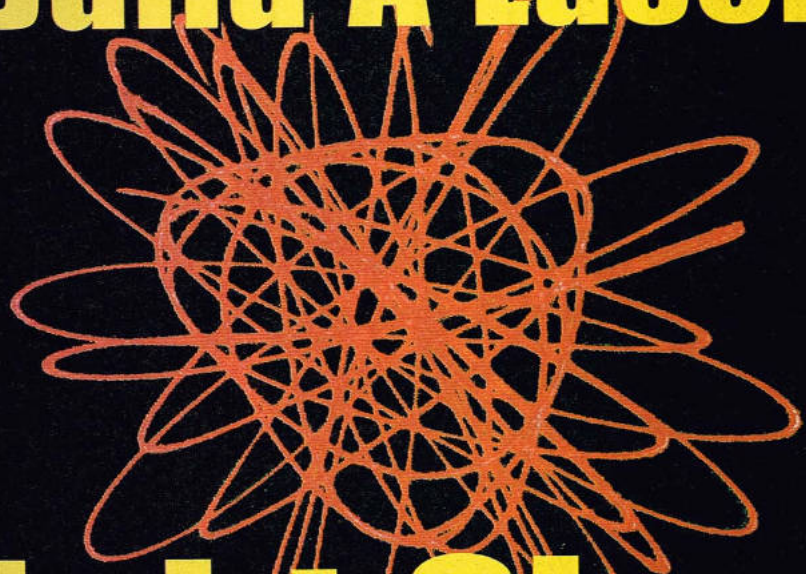
FROM THE PUBLISHERS OF "SILICON CHIP"

Build A Laser Light Show



How would you like a laser light show for your next party? You can build your own and it doesn't need to be a large complex beast with a big laser and so on. This laser display is quite tiny yet it can project a very satisfying display onto the walls of your lounge room.

By LEO SIMPSON

WE DESCRIBED a motorised laser light show in the May 1996 issue but this was a big and bulky beast with a 100mW blue Argon or a 10mW Helium-Neon gas laser, a big power supply and special circuitry for the motor-driven deflection mirrors. Both were very effective and suitable for large venues but they were probably overkill for anyone who just wants a small laser display for parties in their home.

By contrast, this laser light show is very compact and fits into a small instrument case on a swivel stand. Inside, it has a tiny semiconductor laser and its beam is deflected by two mirrors driven by equally tiny motors. Have a look at the photos and you will see that there is almost nothing to it.

This display system employs two DC motors with mirrors on their shafts to deflect the laser beam. The motor shafts do not rotate but simply vibrate around a central tethered position. The level of vibration depends on the level of audio signal applied to the input.

Two motors are provided to deflect the laser beam in the horizontal and vertical directions. And since a typical audio signal is more or less random, the resulting display is endlessly variable, with the beam deflection being proportional to the signal amplitude.

The motors and their mirrors are angled in such a way as to provide optimum deflection of the laser beam.

Due to the mass of the motor armatures and the mirrors attached to the shafts, these small DC motors only produce a useful response to signals of no more than a few hundred Hertz. Bass frequencies are quite effective but midrange and high audio frequencies do not produce any useful beam deflection. But the available response still produces a very useful and interesting range of laser patterns.

While the range of mirror deflection is set by the amplitude of the low frequency audio signals, the central position of each mirror is fixed by a small strip of polycarbonate film between the motor shaft and body.

Circuit description

Two audio signals are needed for this laser drive circuit but since we can only use bass to lower midrange

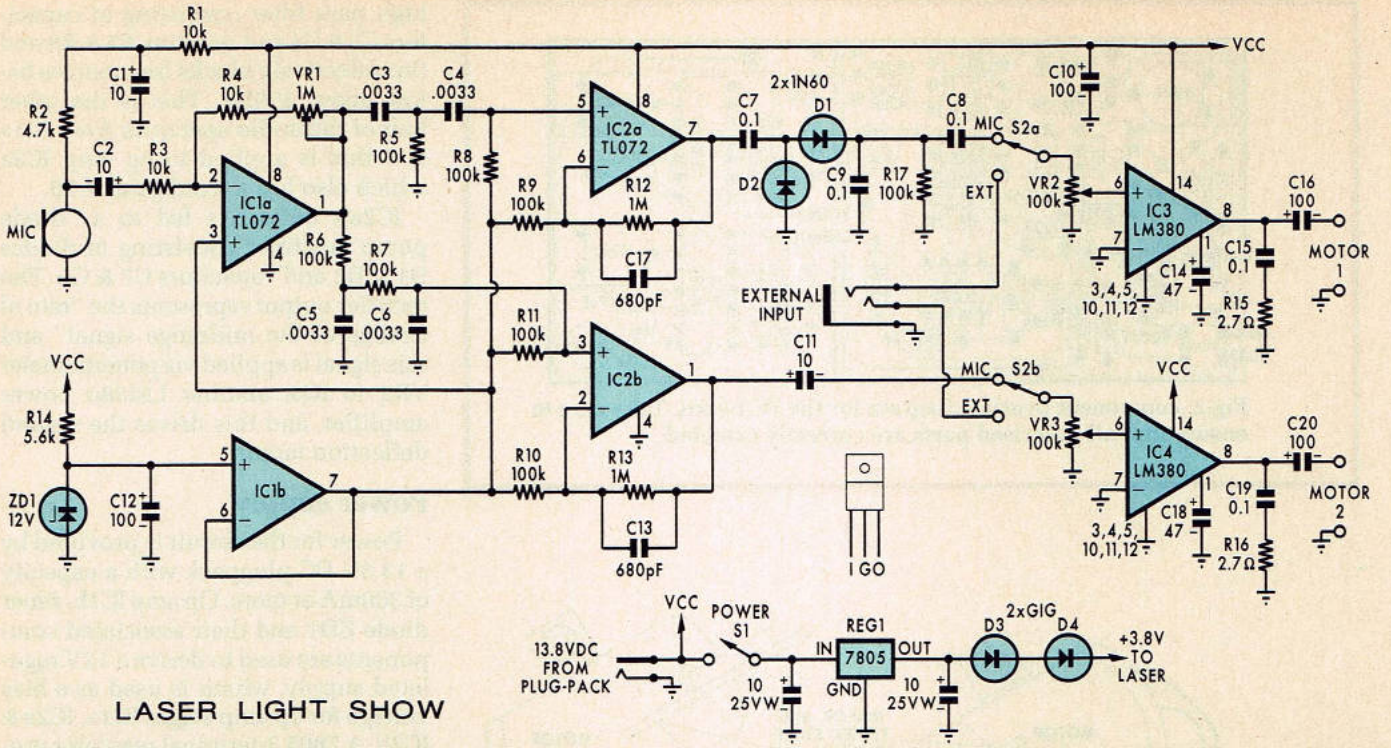


Fig.1: the circuit has an electret microphone to pick up music signals and these are used to drive two small DC motors.

frequencies there is really only one signal present in typical program material, whether it is stereo or mono. As an aside, most stereo tapes and CDs have very little separation between the left and right audio signals in the bass region, hence there is really only one bass signal.

This circuit gets around that problem by feeding one of the motors with straight bass while the second motor is fed with a signal derived from the midrange to treble part of the spectrum. This signal is rectified and filtered. In effect, the derived signal is the rate of change (or envelope) of the midrange to treble signal.

The resultant pattern produced by the laser simply depends on the sound picked up by the an electret microphone. Different types of music and sounds tend to generate their own unique patterns and you may find yourself playing music chosen more with an eye to the laser pattern rather than how it sounds.

Looking at the lefthand side of the circuit (Fig.1), resistors R1 & R2 and capacitor C2 provide a decoupled supply voltage to the electret microphone. The output from the electret microphone is coupled via a 10µF capacitor to the first amplifier stage involving op amp IC1a. This is configured as an inverting stage with a gain depending on the setting of VR1. This can range from unity to about 100.

Liven up your next party with this compact laser light show. Use it to produce endless patterns on your living room walls.

Following IC1a, the amplified electret signal is fed via two paths. Path number one is via a low pass filter consisting of resistors R6 & R7, together with capacitors C5 & C6. This filter effectively blocks frequencies above about 350Hz before they are fed to op amp IC2b which has a fixed gain of 10. The output from this stage is applied via VR3 to IC4, an LM380 power amplifier, and this is used to drive one of the deflection motors.

Path number two from IC1a is via a

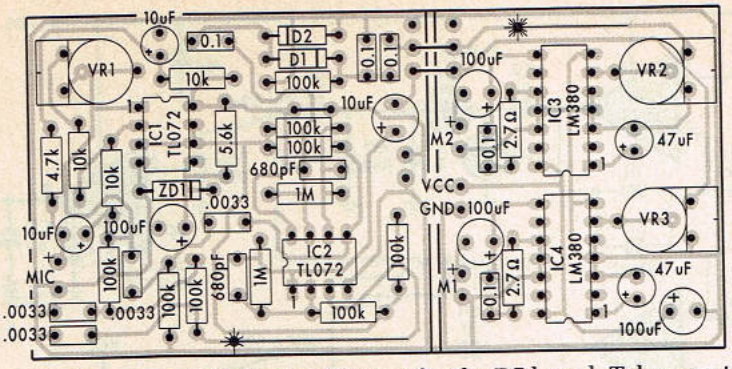


Fig.2: component overlay diagram for the PC board. Take care to ensure that all polarised parts are correctly oriented.

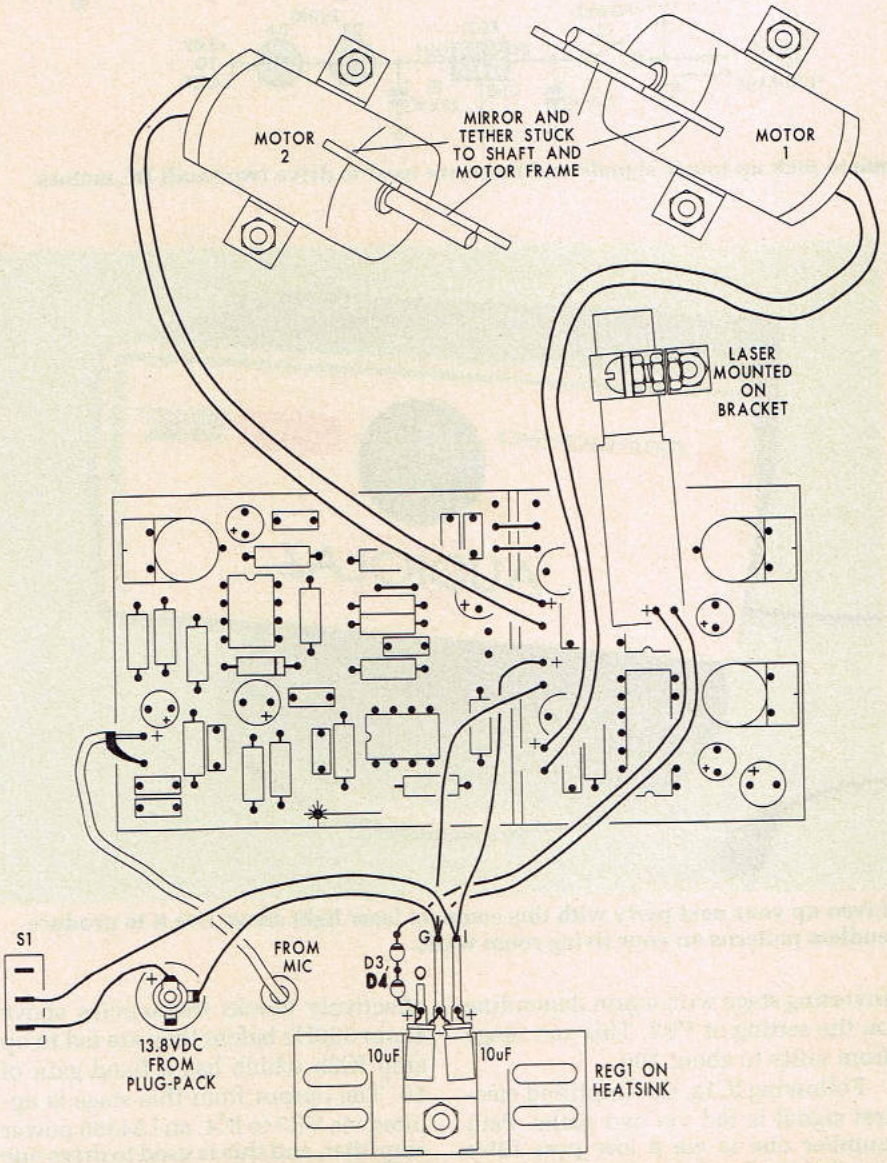


Fig.3: use this diagram when wiring up your laser display. Power comes from a 13.8V DC plugpack supply.

high pass filter consisting of capacitors C3 & C4 and resistors R5 & R8 and this effectively blocks frequencies below about 350Hz. This is the other half of the audio spectrum from IC1a and this is applied to op amp IC2a which also has a fixed gain of 10.

IC2a's output is fed to a "diode pump" rectifier consisting of diodes D1 & D2 and capacitors C7 & C9. The rectifier output represents the "rate of change of the midrange signal" and this signal is applied via potentiometer VR2 to IC3, another LM380 power amplifier, and this drives the second deflection motor.

Power supply

Power for the circuit is provided by a 13.8V DC plugpack with a capacity of 300mA or more. Op amp IC1b, zener diode ZD1 and their associated components are used to derive a 12V regulated supply, which is used as a bias voltage for op amp stages IC1a, IC2a & IC2b. A 7805 3-terminal regulator provides a fixed +5V rail for the solid state laser module.

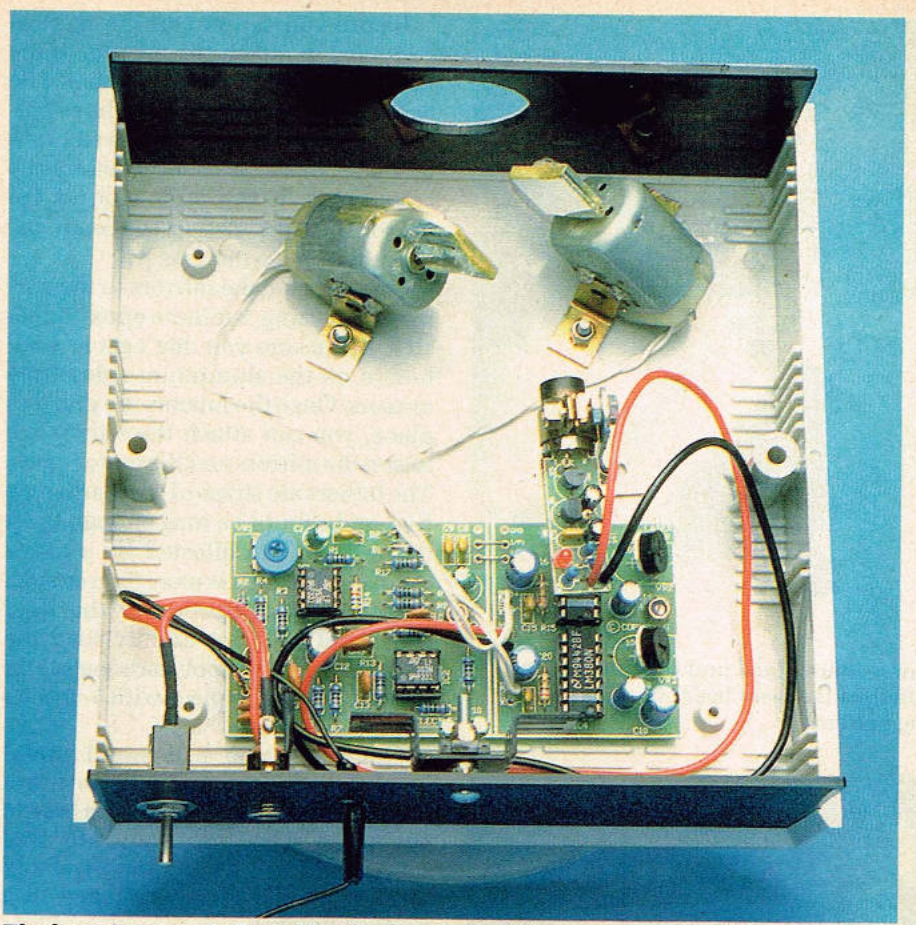
Also shown on the circuit is a DPST switch (S2) which makes provision to drive the motor deflection circuits from a stereo amplifier (ext).

Construction

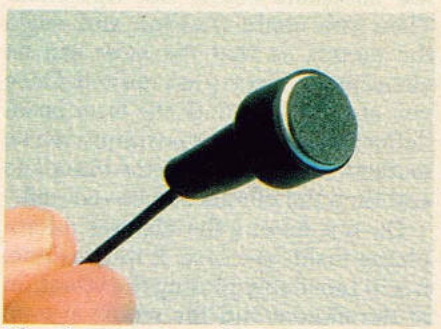
All the circuitry, apart from the solid state laser module and the 3-terminal regulator, is mounted on a PC board measuring 96 x 47mm. This board is divided into two sections, one involving IC1 & IC2 while the other accommodates the two power amplifiers, IC3 & IC4. Two links between the two sections allow you to add the DPST switch S2. Our prototype does not include this and provided the electret microphone picks up adequate audio signal, it is more convenient without any need for audio signal cables.

The first task in assembling this project is to assemble the PC board and this is quite straightforward since it comes with the component overlay screen-printed on top – see Fig.2. Insert all the smaller components first, followed by the trimpots, electrolytic capacitors and lastly, the ICs. IC sockets can be regarded as optional.

When the board assembly is complete, connect up the 13.8V DC power supply and the two motors. With no signal, nothing much happens. However, when you speak or blow into the electret microphone, the motor shafts



The laser beam is deflected by the two motor-driven mirrors (top) in response to audio signals from your music system.



The electret microphone picks up the audio signal and feeds it to the circuit via a shielded cable.

should vibrate rapidly back and forth.

Case work

The next step is to wire up the 3-terminal regulator. This is mounted on a small finned heatsink and the external capacitors are soldered between its three legs. The two power diodes are wired in series with the output terminal and all connections are then secured with small-diameter heatshrink tubing.

You will need to drill a large hole of between 20mm and 30mm in the front panel for the laser to be aimed through. Ideally you should use a hole punch for this job but if you don't have one, you can drill a smaller diameter hole and then ream or neatly file it out to size.

On the rear panel, you will need holes to mount the 3-terminal regulator, DC socket and power switch and a small hole for the electret microphone cable.

On the base of the case, you will need to drill holes to mount the PC board, the two motors, the solid state laser module and the swivel stand. Fig.3 shows how all the wiring should be run to the motors, PC board and so on and the photographs give a further guide to the orientation of the motors and laser module.

Motor mounting

Earlier on, we implied that one motor is used for vertical deflection and the other is used for horizontal deflection of the laser beam. They could be arranged to do this but it is far more convenient to mount each motor with its major axis at 45 degrees to the horizontal and angled in such a way that the laser bounces off one mirror to the next and then shines out through the front panel hole.

Parts List

1 plastic case, 154 x 65 x 158mm
1 swivel stand to suit
2 miniature DC motors
2 small aluminised glass mirrors
1 solid state laser module
1 finned heatsink to suit 3-terminal regulator
1 PC board, 96 x 47mm
1 13.8V DC plugpack with 2.1mm DC plug
1 DC socket to suit
1 electret microphone insert
1 SPST miniature toggle switch (S1)
1 1MΩ horizontal trimpot (VR1)
2 100kΩ horizontal trimpots (VR2)

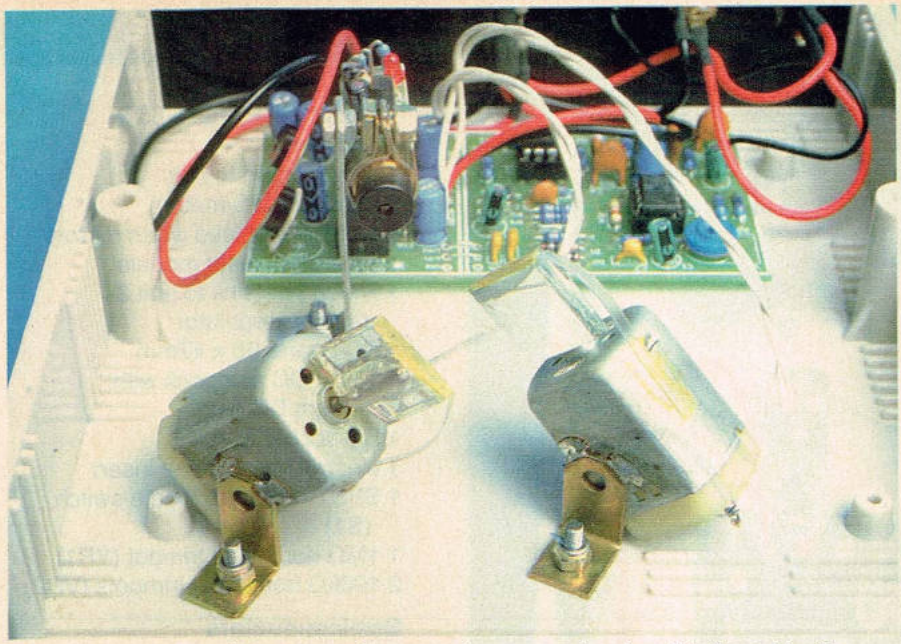
Semiconductors
2 TL072 dual Fet-input op amps (IC1, IC2)
2 LM380N power amplifiers (IC3, IC4)
1 7805 5V 3-terminal regulator (REG1)
1 12V 400mW zener diode (ZD1)
2 1N60 small signal diodes (D1,D2)
2 G1G rectifier diodes (D3,D4)

Capacitors
4 100µF 16VW or 25VW PC electrolytic
2 47µF 16VW PC electrolytic
5 10µF 16VW or 25VW PC electrolytic
5 0.1µF monolithic or MKT polyester
4 .0033µF monolithic or MKT polyester
2 680pF ceramic

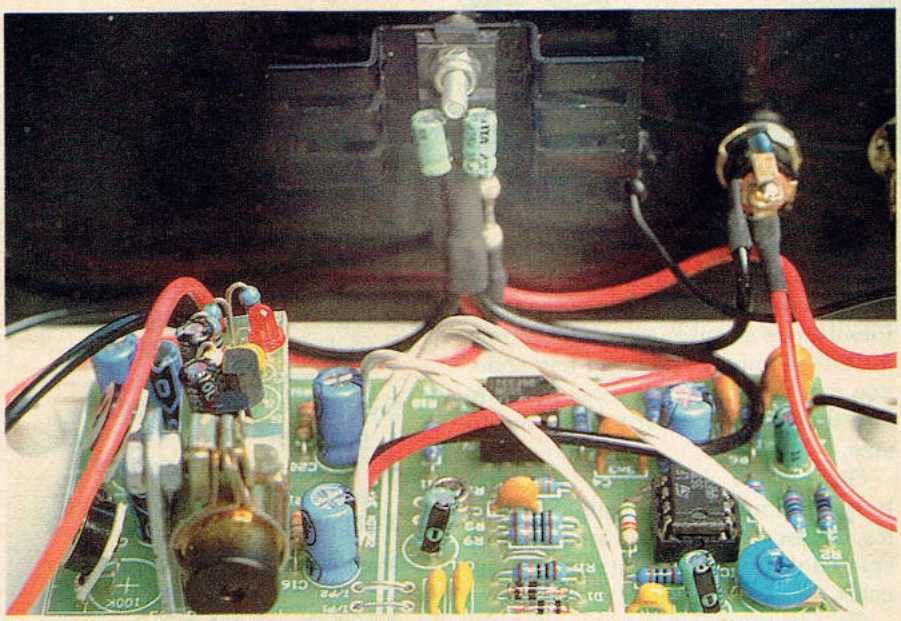
Resistors (0.25W, 1% or 5%)

2 1MΩ	1 5.6kΩ
8 100kΩ	1 4.7kΩ
3 10kΩ	2 2.7Ω

Miscellaneous
Motor brackets, laser module bracket, polycarbonate strip, 5-minute epoxy adhesive, shielded cable, solder.



This close-up view shows how the two mirrors are glued and tethered to the motors. The tethers allow the mirrors to deflect the laser beam by about ±30°, which is enough to produce an interesting pattern



The 3-terminal regulator and its associated parts (including the heatsink) are mounted on the rear panel.

Where To Buy The Parts

All parts for this project are available from Oatley Electronics who own the design copyright. Their address is PO Box 89, Oatley, NSW 2223. Phone (02) 9584 3563; fax (02) 9584 3561. The prices are as follows:

PC board plus on-board parts, motors, mirrors, electret microphone	$44.00
5mW 650nm laser module	$25.00
13.8V 1A DC plugpack	$12.00
Complete kit, including all above parts, 3-terminal regulator & case	$85.00

Before you can mount the motors, you need to attach the mirrors to the shafts and fit them with tethers. The two small mirrors supplied have aluminium metallisation on one side and this side must be used to reflect the laser beam. If the glass side of the mirror is used to deflect the beam, the effect will be to defocus it.

You can glue the mirrors to the mirror shafts using 5-minute epoxy adhesive. Make sure you don't get any adhesive on the aluminium side of the mirrors. Once the mirrors are glued in place, you can attach the tethers between the mirrors and the motor cases. The tethers are strips of polycarbonate film and should be long enough to let the mirrors be deflected by a maximum of ±30°. This is more than enough to give good deflection of the laser beam and will not unduly load the motors. Again, the polycarbonate tethers can be glued in place with 5-minute epoxy adhesive.

Our prototype had small metal brackets soldered to the motors and these were then screwed to the base of the case. The laser module was mounted by holding its lens assembly with a circular clamp attached to a vertical bracket.

In practice, you could mount the laser as shown in the photos but with the baseplate screw not tightened. Then you could position and angle the motors so that the laser can be aimed and deflected as required. Once you are satisfied with the laser beam deflection, the motor positions can be marked, holes drilled in the baseplate and then the motors can be secured.

Do not mount the electret microphone inside the case. If this is done, it will inevitably pick up the vibration of the motors and the whole system will then oscillate at a low frequency. This is the reason for connecting the electret microphone via a length of shielded cable. That way, it can pick up sound from your music system rather than from the motors.

The electret microphone insert used in our prototype has the shielded cable attached directly to its rear lugs and then it was neatly shrouded with heatshrink tubing to anchor and provide stress relief for the cable.

Before you can put the Laser Light Show to use, you will need to adjust trimpot VR1 for adequate gain from the electret and then set VR2 and VR3 for optimum mirror deflection. **SC**

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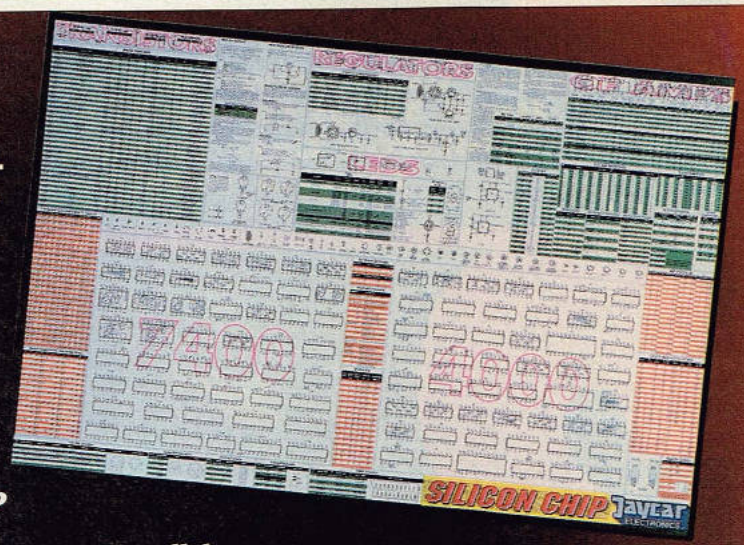

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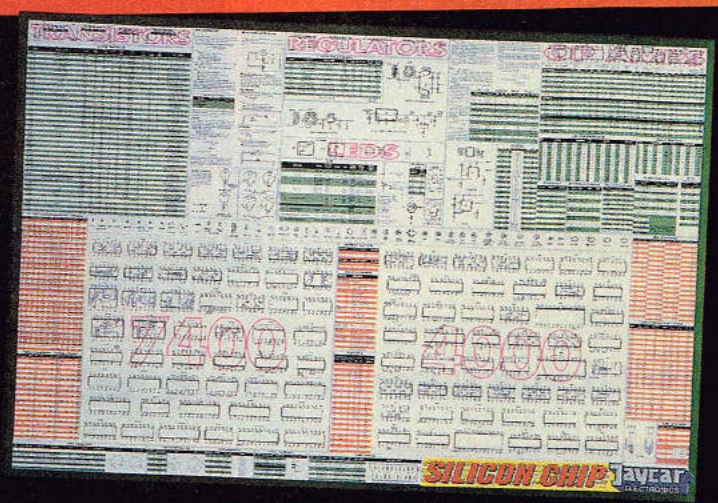

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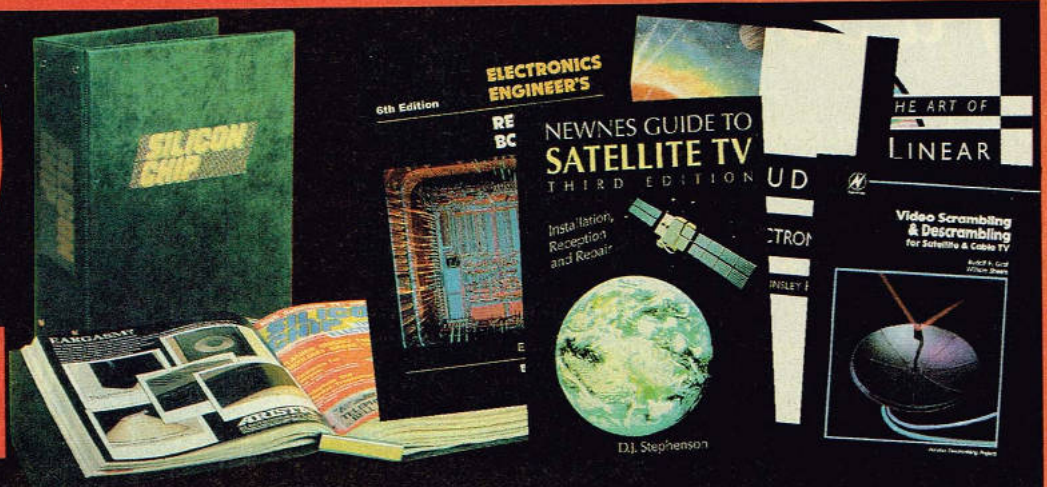

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Automatic discharger doesn't

I have just built the automatic discharger kit for nicad battery packs, as published in September 1994. I find that it will not work. The voltages are as follows: (1) across pins 8 & 4 of IC1 = 5V; (2) across REF1 = 0V; (3) VR1 adjusted to 0.49V. Above 0.49V, the voltage disappears. Supply to kit = 6V. Have changed REF1 with no results. Both LEDs work – discharge and reverse polarity. (J. N., Leongatha, Vic).

● From the symptoms, it appears that there is a short across the tracks for REF1. The fact that you changed REF1 with no result means that the short is probably a solder splash across the tracks or an etching fault. You will need to closely check this area of the board to find the fault.

Electronic braking explained

For Christmas I received a Ryobi 9.6V cordless drill with electronic braking and I was wondering how the electronic braking system works.

Could you please shed some light on this subject, with perhaps a circuit schematic to make things easier to understand? (D. B., Allenstown, Qld).

● We are not sure how the braking on your drill works but the normal scheme is to connect a direct short or a low value resistor across the motor, after the DC supply is disconnected. This could be done with a relay or a transistor. We would guess that since your drill has "electronic" braking, the switching is done by a transistor.

This form of braking works because when a permanent magnet motor is shorted out, it is forced to operate as a generator and since it is delivering a high current into the short circuit, this places a large mechanical load on the armature and hence the motor is quickly braked to a stop.

As a matter of fact, the garage door opener featured elsewhere in this issue has a similar braking scheme, with a 1Ω resistor switched across the motor by relays.

Diesel-electric locomotives use the same system of braking. There it is called "electrodynamic braking" and the large currents generated by the bogie motors are dissipated in large resistor banks on the roof of the locomotive.

DCC and Command Control

I am very keen to build the Command Control system for model railways which is presently being described in SILICON CHIP. In fact, I have gone so far as to buy most of the parts for the Command Station described in the February 1998 issue. But now I have come up against a stumbling block. I can't buy the 74163 synchronous counter ICs. I've tried every where and I've come up with a blank. Can you point me in the right direction?

While you're at it, can you tell me if this Command Control system is compatible with the DCC systems often mentioned in overseas model railway publications? (R. M., Darwin, NT).

● The 74163 is made by Motorola with the designation MC14163BCP. It is available from Farnell Electronic Components and their Cat. No. is 704830. Their phone number is (02) 9645 8888.

DCC is not compatible with Command Control. While the operating principles are similar, DCC will control up to 128 trains or other devices but a typical DCC system is likely to cost far more than the Command Control system we are describing.

No mods for the audio power meter

I recently purchased an audio power meter kit as published in the April 1993 issue of SILICON CHIP. I wish to use it with a 300W amplifier. I was wondering what would need to be done? I assume that changing the 1kΩ and 4.7kΩ resistors from pins 6, 7 & 8 of IC1 would do the trick. If so, could you suggest the right values? (A. M., Seymour, Vic).

● No circuit modifications are required to allow the power meter to run with a 300W/4Ω amplifier. As discussed at the end of the article, all that is required is to set the value of trimpot VR1. To light up all LEDs with a 300W power output, trimpot VR1 should be set to 53kΩ. The 1kΩ and 4.7kΩ resistors at pin 8 of IC1 should not be varied because they also set the brightness of the LEDs.

Powering a laptop from 12V

Thank you for an interesting magazine. The writer of a letter in the November 1997 issue seemed to have the same problem as I have: powering a laptop from a 12V boat supply. The inverter and computer power supply waste precious power. My laptop external supply produces 20V and its battery produces 12V. I am happy to reproduce either of these if possible. The boat system varies from 14V to well below 12V, depending on whether the engine is running or the batteries are low.

At your suggestion to the letter writer, I ordered the July 1996 issue to study the 2A SLA charger but this also pushes up to 13.8V. Is there a way to have the voltage stay just at 12V to mimic the computer's battery or just at 20V to mimic its power supply? (S. W., Airlie Beach, Qld).

● It is possible to fix its output at 12V instead of 13.8V. All that is required is to connect a 150kΩ resistor in parallel

with the 22kΩ feedback resistor to pin 5 of IC1. This approach should be more efficient than increasing the output to 20V DC.

Bell sound goes "dink dink"

I have a problem with the "Sounds & Lights" module for model railway level crossings, as described in your "14 Model Railway Projects" book. Although everything checks out all right, 10V across ZD1, lights flashing correctly etc, the bell sound is not what it should be; in between the "dink" and "howl" is where the bell should be but, by adjusting VR3, I can only get dink or howl.

The only time I get a couple of bells is when I disconnect the 12V feed; it discharges the capacitor, the value of which is 1000µF. I have exchanged the LM324 for another one but this made no difference nor did a change of speakers. I would be obliged if you could give me some hints how to improve this project. (J. O., Rotorua, NZ).

● Your level crossing lights and bell circuit appears to have a problem with the IC3c oscillator or bell striker from IC3a. Try changing the 100kΩ resistor at pin 8 of IC3a to a larger value. If this does not help, alter the 33kΩ resistor at pin 14 of IC3c to a smaller value.

Use a 1000µF capacitor for the decoupling across the supply, as shown on the circuit and parts list.

Dog chaser wanted

I live in an area where there are a number of savage dogs running free and I want an ultrasonic device to deter them from attacking. Have you published such a device and if so, in which issue? (Name and address withheld).

● While we did publish two projects designed to discourage dogs from barking (Woofer Stopper, May & June 1993; Woofer Stopper Mk.11, February 1996), neither of these could be expected to discourage a dog from attacking. In fact, if a dog is about to attack, it is possible that such a device may increase the likelihood of it happening.

One reason why an ultrasonic device may not discourage a dog from attacking is that some dogs are quite deaf. Second, some dogs attack because they are frightened and using an ultrasonic stimulus may only increase their fear. Third, some dogs are so aggressive and dangerous that there is little you can do to avoid an attack if you are close to them.

If there are dogs which are known to be aggressive and they are running free, you should report them to your local council and in serious cases, to the police. You could save someone from serious harm.

TENS unit not delivering

I built the TENS Unit described in your August 1997 issue. On testing I was able to set 80V at the drain of Q1. The voltage at pin 1 of IC2 was only

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Diesel sound can be improved

Your "14 Model Railway Projects" book featured two projects I would like some information on. First, the Railpower/Infrared Remote Control project has a milliamp meter for a "speed setting" indication. This is connected between pin 1 of IC9a and VR6.

As I understand it, pin 1 of IC9a is a buffered voltage reference identical to the voltage across the 2.2µF capacitor at pin 3. Can I take this voltage and use it to drive another related project?

The second project I am referring to is the "Diesel Sound Simulator". This clever project has one flaw – the back-EMF pitch control which speeds the diesel up as the train gathers speed. But real locos rev their guts out to overcome inertia, then slacken off as they reach their selected speed. For more realism, could I feed the voltage referred to earlier into D2 and omit ZD1, Q1 and their associated resistors?

Obviously I am going to be mounting the Sound Simulator at the trackside, not in a wagon or loco. Doing this would give a diesel pitch proportional to the speed setting gauge, giving the revving action described. (B. S., Dargaville, NZ).

● As you have surmised, pin 1 of IC9a is a buffered version of the speed signal and it could be used to control the diesel sound generator. This would result in the diesel sounding like it had a higher throttle setting but there would then be no variation at all in its pitch.

As you have suggested, diesels do rev up to start a heavy train and then throttle back as it comes up to speed, provided it is not pulling a heavy load on a gradient. It seems as though you would like a further refinement, whereby the loco starts out with a high throttle setting (from pin 1, IC9a) but this is tapered back somewhat after a delay. This might be possible using a capacitor network to bleed off the signal voltage after a delay.

8.6V instead of the recommended 15V. With pulse width and pulse rate pots turned fully clockwise, I measured only 0.4V on pin 6 instead of 2-3V, indicating that switching was not taking place. With all pots set to maximum, the output is only 1.3V AC. I have changed IC1 with the same results. (R. Q., Lakemba, NSW).

● The measurements which you made from the TENS output are only a guide as to whether the unit is delivering a voltage or not. The actual voltage depends on the type of multimeter and its loading on the circuit.

Since you are measuring up to 1.3VAC, we can assume that the TENS Unit is delivering some voltage. All you need to do now is try it with electrodes fitted. If you "feel" a strong tingle on the skin when these are attached, the unit is working correctly.

Connecting a CD player in a car

As you have some great projects for cars, I thought I'd write about mine. It doesn't have any electronics, although you might be able to develop an automatic switch if you like the idea and want to expand it.

Now that (most) portable CD players have electronic shock protection they are ideal for cars. Unfortunately the cassette adaptor is at best a poor compromise and FM transmitters are generally not practical. Plus it is a real hassle having to remove the adaptor and or (cigarette lighter) power cord every time you leave the vehicle.

To overcome the quality and inconvenience problems, I attacked my cassette-radio and cut the circuit board tracks that lead to the high side of the volume control. I attached four shielded cables through the back of the unit and fitted them with colour coded in-line RCA plugs and sockets (one colour for each channel).

A switch box was constructed with four cables terminating in plugs and sockets to match those from the radio. The switch box was fitted with a socket to accept the output from the CD player. To round off the project I fitted an in-line cigarette lighter socket that I connected to the back of the built-in unit. The switch box and power socket sit in the glove box along with the player. Now the sound is superior and there are no messy wires showing to invite thieves.

The only real disappointment is that the balance and tone controls come before the volume, so I have lost these functions when playing CDs. (W. B., Wheeler Heights, NSW).

● While your approach does work, it would be better to feed the CD signal into the point before the balance and tone controls. The most convenient point would be at the switch which selects radio or cassette operation. We would suggest that you use a 3.5mm stereo switching socket which would enable normal operation of your radio cassette when the CD is disconnected.

Power tranny for 5-channel amplifier

I am planning to build a 5-channel amplifier for a surround sound system. It will consist of four 50W amplifiers for the left, right, centre and surround channels and one 100W amplifier for the subwoofer. They are all ETI 480 modules so they can all run from the same supply. The original power supply design has supply rails of ±40VDC at no load, dropping to ±32VDC when running two 50W (or one 100W) amplifiers at full power.

As the total current to run the five modules at maximum is 7.2A, I'll need a 500VA transformer from Altronics. The original power supply uses a 28-0-28VAC/2A transformer and the only close voltages Altronics have available are 25-0-25VAC or 30-0-30VAC. The original article says that if a regulated supply is used for the amplifiers, it shouldn't exceed ±35V DC. Which transformer should I use?

If you recommend a 25VAC transformer, would a 300VA transformer be enough? Would larger smoothing capacitors make a 300VA transformer feasible? I'd like the power supply to be capable of running the five modules to their maximum output. I've included the circuit diagram of the original and my "proposed" power supply. (T. H., Railton, Tas).

● Our suggestion is to choose a 300VA 25V-0-25V transformer. This will result in supply rails of around ±35V DC, depending on the total quiescent (ie, no signal) current of the five amplifier modules. For filtering, we would suggest a minimum of 20,000µF on each supply rail.

Building the induction balance metal locator

I am building an induction balance metal detector to locate metal marker pegs in rough terrain. I am using the circuit published in the May 1994 issue of SILICON CHIP but I am having difficulty obtaining the TL496C (8-pin DIL) voltage converter. Could you please tell me where I can obtain one from, or an equivalent? (G. C., Christchurch, NZ).

• The TL496 can be obtained in Australia from Farnell Electronic Components, provided you have an account or a credit card. Their phone number is 612 9645 8888. Failing that, you could try obtaining it from the Motorola or Texas Instruments distributors in New Zealand. Finally, you may consider building the metal locator without the TL496 and just use a 9V battery supply instead, comprising six AA cells.

Background hum in Dolby Decoder

I have just finished the Dolby Pro Logic Surround Sound Decoder Mk.2 featured in the October & November 1997 issues. During the soak test, I am happy to report that everything works just as outlined in the article. The only problem I have is that there is a lot of background hum.

I have used earth shielded cable in every place outlined in the article. The case earth from the mains plug is present and most important, the 0.47µF cap was soldered between the signal earth and mains earth. It doesn't matter what setting you have any of the switches in, the hum gets worse as you increase the main volume control (VR1). With the volume at zero, the hum has all but disappeared.

I built up six kits of the first Pro Logic Decoder you presented and teamed these up with 50W power amplifiers which I also mounted in the same case and did not experience any noise or hum at all. They were very quiet. What do you think is the problem?

Could it be radiation between the transformer and the processor board IC6? Would it help if I use a piece of metal to screen the two from each other? I have carefully checked all earth shielded connections from the pots and other various points on the main PC board. I would like to comment by saying that having all the audio cable connections in the centre of the main PC board is very untidy and hard to achieve. Would it help if I remove the large transformer and the three power amplifiers from the case altogether and mount them in a separate case and refit a much smaller transformer in the decoder case? If so, what size transformer should I use? (K. S., Morphett Vale, SA).

• Your hum problem is almost certainly an earthing problem. We do not recommend completely rebuilding the unit with the power amplifiers and transformer in another case. This would be completely unnecessary since our prototype unit was as quiet as the first version of the Pro Logic Decoder.

First, check the isolation between the heatsink tab on the power amplifiers to case, using a multimeter set on "ohms". There should not be any connection and the meter should show a high resistance or open circuit. If the resistance is low, check the insulating washer between case and the amplifier tab and also check the insulating bush.

Next, check that the signal earth (the shields on the audio leads) do not connect to mains ground by checking for resistance to the case of the decoder. Finally, check the earthing to the power amplifiers. We have shown shielded wire connecting from the decoder board to the power amplifier board. Make sure that the shields connect the signal earth to the amplifier board as shown on the wiring diagram.

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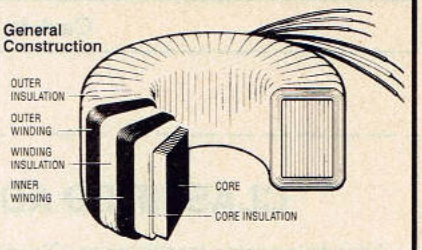

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Notes & Errata

Nicad Zapper, August 1994: experience has demonstrated that this circuit does not dump the capacitors' charge reliably if the supply rail is less than about 12V. Also, the test procedure involving a 2.2Ω dummy load should be changed to 0.22Ω.

Some variants of the MTP3055 have also proved to be unreliable. We recommend the MTP3055E, made by Motorola. Less well-known brands can be suspect.

5-Digit Tachometer, October 1997: the PC component diagram on page 25 has link LK1 incorrectly labelled. In fact, the unlabelled link next to it, connecting to pin 6 of IC5, is LK1. **SC**

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Philips DVD Player . . .

continued from page 7

Fast forward at 8 or 32 times normal speed merely flicks from frame to frame so it is not fast forward in the normal sense.

All of which means that fast forward and reverse operation is not available in the way that you expect from a conventional VCR. In fact, after using the remote control I think that the Jog/Shuttle control should be deleted altogether. It's a handy feature on a VCR if you want to do editing but that's not really what the average user is likely to want to do. It would be better if the designers incorporated normal fast forward and reverse buttons with perhaps other buttons needed to be pressed to increase the speed of motion.

I may have dwelt on the remote control in what appears to be unnecessary detail but really, since the machine must be operated by the remote control, it is appropriate to dwell on its merits and shortcomings. On balance, it doesn't pass.

In summary

Really, the DVD840 is a very fine piece of up-to-the-minute technology. It gives flawless video and audio performance but it is let down by the operating features of its remote control. The recommended retail price of the Philips DVD-840 is $1495 and it is available from selected retailers throughout Australia. Current movies are being released by Village Roadshow on DVD at $34.95 each.

And now I must return to the theme mentioned at the beginning of this review and that is the suggestion that perhaps DVD players may not initially set the world on fire as a consumer product. In my household, there are three people who are inveterate video tapers. I am not one of them so my opinion probably carries less weight than theirs.

They are always taping some show or other to watch later or to be saved for reference for sometime in the future. Otherwise they are often renting tapes which they will watch several times before they are returned. How did these video users react to the superior technology offered by the DVD player? The simple answer is that they were unaware of it.

They did not notice the superior picture or sound quality and while they did play with the remote control and some of its functions they were just blase about it. When questioned about the merits of the player, two comments they made were notable and succinct: "You can't make it fast-forward easily" and "You can't record!" The last comment is perhaps the most telling. Draw your own conclusions. **SC**

Advertising Index

Altronics 24-26
Bainbridge Technologies 91
Cybec Pty Ltd 31
Dick Smith Electronics IFC,OBC,8-11
Embedded Pty Ltd 91
Emona 65
Harbuch Electronics 93
Instant PCBs 95
Jaycar 45-52
Kalex 69
Microgram Computers 3
MicroZed Computers 95
Oatley Electronics 33
Premier Batteries 65
Preston Electronics 95
Printed Electronics 95
Quest Electronics 21
Rola Australia 95
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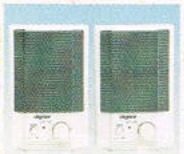

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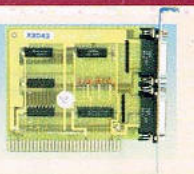

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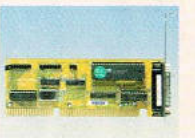

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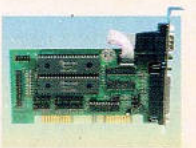

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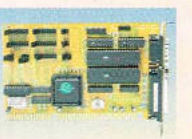

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* 60 Nanoseconds

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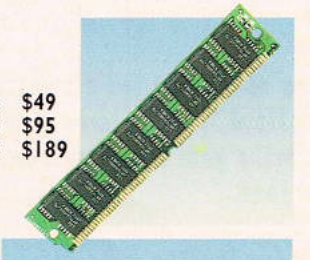

168 Pin Synchronous DRAM

16MB 2 x 64 X 7378

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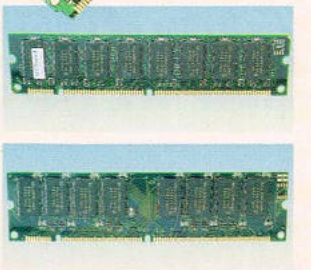
32MB 4 x 64
X 7379

$199



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